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AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.
ISSUED WEEKLY BY THE AMERICAN MACHINIST PRESS,
Vol. 22. 218 WILLIAM STREET, NEW YORK. No. 13.

Contents and Index to Advertisers, Page 8.

Faith without works availeth nothing.

Believing our story will not save you one cent.

Disbelieving it will not change the facts.

If you want to reduce the cost of your lathe work, if you want to reduce the cost of your detail forgings, if you want to reduce the cost of assembling or "setting up" your machines, use the Flat Turret Lathe.

Don't say that you have only a few pieces of a kind, for we can make one piece of a kind quicker than it can be made in the old way.

Don't say that you must make your work from forgings instead of the bar—for our Outfit E handles either forgings or the bar—remember too, the forgings are very expensive luxuries, and that much attention and care is required to follow a piece through the blacksmith shop and various operations in the machine shop.

Remember our machine is fully equipped with very simple, efficient and convenient tools—over 1000 machines have been sold—all the same size and with nearly the same outfit of tools which have met the requirements of hundreds of different kinds of business, and this fact testifies to the almost universal adaptability of our machine and outfit.

Don't forget that other machines are not so equipped. Remember that it requires weeks and hundreds of dollars to equip other machines with tools, and that such tools are of little or no value for anything excepting the work for which they were made—that new work generally requires new tools—that only overhanging, inconvenient, delicate cutters are available for other machines.

Buy a Flat Turret Lathe, or buy a few more Flat Turret Lathes. Each machine is a complete machine shop in itself for all lathe work from the bar under 2 inches in diameter and less than 24 inches long, and many forgings of larger diameters.

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Jones & Lamson Machine Co.,

Springfield, Vt., U. S. A., and

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Henry Kelley & Company, 26 Pall Mall, Manchester.
Office for Germany, Holland, Belgium, Switzerland, and Austria-Hungary:—M. Koyemann, Charlottenstrasse 112, Dusseldorf, Germany.
France:—Ph. Bonvillain, 6, Rue Blanche, 6, Paris.

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Our Catalog (3½ x 6 in., 88 pages) of Grinding and Polishing Machinery, Countershafts, Universal Belt Shifters, Wood Wheels, etc., may be obtained upon application to us or to leading Machinery and Supply Dealers throughout the country.

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FOUNDERS AND MACHINISTS,
CODDING, WESTMINSTER AND DODGE STS.,
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BUILT BY THE
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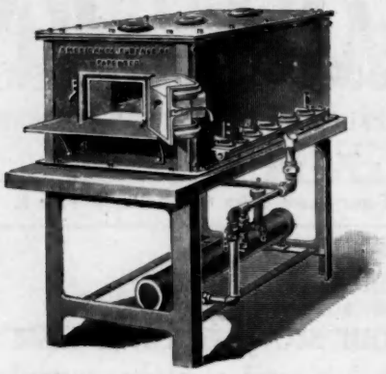

and he uses our Case Hardening Gas Furnaces in his money factory, at Philadelphia, for annealing die blanks and for hardening dies. Some other people who know a thing or two about case hardening and annealing are the S. S. White Dental Mfg. Co., who spent a lot of money looking for the right thing and failed to find it until they were introduced to our Gas Furnaces. They use our Furnaces for annealing forcep stock and blanks and other particular work.

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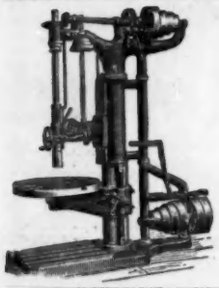

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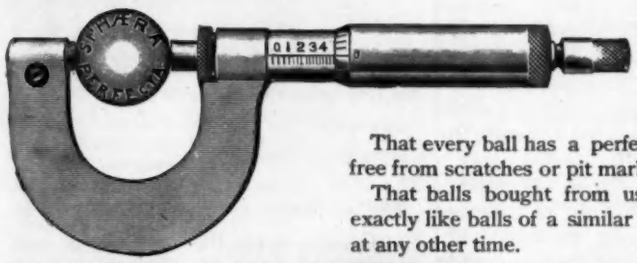

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AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION

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AMERICAN MACHINIST

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Advertising Department.

C. P. DAY, Eastern Representative.

JOHN MCGHIE, Western Representative.

Space in advertising pages only is for sale.

We invite correspondence on subjects pertaining to machinery.

Name and address must always be given, though not necessarily published.

Communications for or relating to the reading columns should be addressed to the Editor. All business communications should be addressed to the Company.

Subscribers can have their mailing address changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once. Date on wrappers denotes week with which subscription expires.

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No back Numbers beyond 1898.

An Improvement.

Our editorial page and commercial review have been transferred to the front of the paper in order to enable us to use to better advantage the increased space resulting from the enlargement of the paper. The manufacture of the "American Machinist" involves some problems that have proven interesting, though at times a little intricate. No weekly paper with an edition as large as ours can be printed and illustrated as it is and gotten into the hands of its readers so soon after closing the forms except by the adoption and full use of every known means of facilitating good work.

We must illustrate and describe the latest and best things in machine shop equipment and at the same time give the current news of the business as fully as possible.

As at present arranged the sixteen pages from 21 to 36, inclusive, are printed in one form, which is the first to go to press and on which most time is spent in preparation and printing. It is the intention to confine all half-tone illustrations to this form. The first four reading pages (17 to 20, inclusive) and pages 37 to 40, inclusive, make an eight-page form, which goes to press last and is printed rapidly. Half-tones will not be used in it, and thus we shall be able to make room for both reading matter and advertisements that are delayed until the last moment.

This change needs, we think, no apology, but as a matter of fact, is made necessary by the continued growth of the paper and our desire to maintain the relative proportion of reading matter.

Compressed Air for Fire Engines.

We have all heard of the compressed air autotruck which is in the near future to drive the horses from our streets. In connection with this scheme it is now announced that arrangements have been made for the propulsion of one, if not all, of the fire engines of the city of New York by compressed air. As to what the precise arrangements are we are not informed, but it is not possible for us to believe that they have included the designing of the apparatus to be employed. This little detail seems to be conspicuously absent in several of the compressed air schemes of the day, but the absence does not seem to retard the booming of the stock. The bare announcement of the fire engine arrangement above alluded to put up, twenty points or so, the quotations of compressed air stock not directly interested in the proposed application.

Our mission, under the existing state of affairs, seems to be to call attention to the things which compressed air cannot be made successfully to do, rather than to those for which it is eminently adapted; and one of the most unpromising is its proposed use for the street propulsion of steam fire engines. We have to assume that the fire engine must still remain a steam fire engine, so far as the working of its pumps and the extinguishing of fires is concerned, because it would be impossible to store sufficient air to keep it going more than a few minutes, or certainly not long enough for the steady and protracted service it is so often called on to perform. The receivers for the storage of the necessary quantity of compressed air, the air motors, the mechanism for connecting the motors to the traction wheels, the increased weight of the wheels, and the entire arrangement for steering the machine, would be in addition to the weight of the present machine, which we know is already sufficiently heavy. Self-propelled steam fire engines are no novelty. They have been tried in New York, as well as elsewhere, and have not shown themselves to be practically desirable. The compressed air driver could be in no respect superior to the steam in getting the engine over the ground, or in its manipulation in narrow quarters, and the weight of the machine, with the air storage, must be considerably greater than that of a steam-propelled machine, and the storage reservoirs in addition to the existing boiler must add greatly to the general clumsiness of the concern.

There is but one suggested arrangement under which it would be apparently possible to use compressed air for fire engines with any satisfaction, and that is where a city is fully supplied with compressed air service, and an air pipe is ready at every hydrant beside the water pipe. When that day will be no one can tell. Without a boiler, or a supply of water or fuel to carry, a fire engine could be very light and could be gotten over the ground so easily by horses that the automobile feature would be of little value. The pumps and connections and the motors to drive them need not weigh more than one-half of the present fire engine, but it is useless to talk about it until we have first the air supply everywhere with the water supply.

In our issue of March 9 we illustrated a hand-feed milling machine built by the Fox Machine Company, of Grand Rapids, Mich. Later we received from the Kempsmith Machine Tool Company, of Milwaukee, Wis., a letter stating that the machine referred to differed from their own only in not having the same name-plate, and that on May 26, 1898, they had invoiced one of their machines to the Fox Company. The Kempsmith Company enclosed a photograph of their machine and comparison shows that the one is undoubtedly a close copy of the other, though there are some minor points of difference. We have before expressed our opinion of this practice of dispensing with draftsmen and designers' services at the expense of one's neighbors, and need not now characterize it, but when a copied

machine inadvertently gets into our reading columns justice and fairness require that we should state the facts about it as they may come to us as a result of such publication. Those who may object to such statement of facts must be careful to send us for illustration machines of their own design only.

The usual impression would be that steel pinions in machine construction must necessarily cost considerably more than cast gears. It has been found, however, that in manufacturing operations they may actually cost less, because the mild steel in bars costs about one-half cent per pound less than gray-iron castings, and these bars can be worked into the blanks for the gears by automatic machines, one man on such work being easily able to keep seven machines running. The cutting of the steel gears costs somewhat more than for cast iron, but not enough to make up for the less cost of material and of turning and boring the blanks.

Commercial Review.

NEW YORK SATURDAY EVENING,
March 25.

MACHINISTS' SUPPLIES, ETC.

A high degree of activity still prevails. Shops have so much work on hand that they make heavy demands upon the supply and small tool sellers. March will not unlikely prove the best month of the year to date. February contained unusually few business days, and these were seriously broken in upon by bad weather, but under the circumstances the totals of trade were remarkably heavy. Several houses reported a day or two ago that March trade already equals or exceeds February's total, and for the month an excess of 25 per cent. or over was estimated by them. The sellers are undoubtedly numerous for whom this month will turn out the best in many years or in all time. On the other hand there are some who are now selling less than in the winter months.

The inclement weather of the present week caused a perceptible though slight check to the local trade of some houses.

Announcements of new prices on one thing and another are constantly appearing. Metal goods in general are on the *qui vive*. But the prices on many of the classes of goods important to machinists have eluded increase. Files are at old figures. So, in general, are emery wheels, although several makers of grinding machines have made advances. Twist drills have not been marked up beyond the figure agreed upon last year. Wood pulleys are obtainable on the old basis.

The difficulties in obtaining goods from factory are not over. Yet in several cases, at least, they are lessening, the manufacturers having begun to catch up with their work. This does not seem to be owing to a falling off of demand, but to an increase of facilities. Manufacturers have had time to get the situation in hand.

A man in close touch with the market considers the tendency quite prevalent among manufacturers when overcrowded with orders to favor deliveries upon the later and more profitable ones in preference to older ones received before the advance in prices. It is human nature and policy to take more trouble to please the party with whom you are doing profitable business at the moment, than the one with whom you have a bad bargain of long standing.

The Arcade File Works have lately received an order for 920 dozen files from a Continental hardware dealer, this making the third order from the same source. It was secured in competition with English makers, whose prices, it is stated, are about the same as the American.

MISCELLANEOUS.

An indication of the change that has taken place in the Southern lumber industry is found in a comparison of two cases stated by a local party. Three or four years ago an acquaintance of his residing in Alabama had six saw-mills, five of which were shut down entirely and the remaining one working only from three to six months of the year. A few weeks ago another man well acquainted with Southern lumber matters sought to purchase some lumber in that section. In order to secure it he wrote to thirty mills, of which he received replies from only three, and those three wrote to state that they could not fill his order. These facts indicate that conditions are brightening for wood-working machinery manufacturers. Even if the improved lumber conditions in the South are, as has been stated, accompanied with deterioration in the Northwest, and even if the total output of the industry for the country should not be enlarged, still the awakening of a new section must cause an increased demand for mill equipments.

The Newton Machine Tool Works, Philadelphia, write: "We have just received an order from the Brooks Locomotive works for a duplex milling machine and a vertical milling machine. These are the largest tools used in any locomotive works in this country. We are also building a cold saw cutting-off machine for the steel department of the Otis Steel Company, and two of our steel foundry saws for the Standard Steel Works, at Burnham, making four of this one particular type of tool they have in their works. Would also say we are receiving numerous, both domestic and foreign, orders and are rushed to our full capacity."

The General Electric Company now has 4,700 men employed in its Schenectady works. Of these, 250 are working all night, and every department of the plant is running evenings. The new machine shop is practically finished, so far as the building is concerned. Tool deliveries, however, are nearly six months later than they were promised, and only a few straggling machines have yet been installed.

The treasurer's report of the Pratt & Whitney Company for the past year shows sales amounting to $1,315,603.10, the net profit being $82,940.71. At a meeting of the directors the following officers have been elected: Amos Whitney, president; Rowland Swift, vice-president; Rosewell F. Blodgett, secretary, and J. C. Stirling, treasurer. The second vice-presidency, lately held by George W. M. Reed, was left unfilled.

The Baldwin Locomotive Works, Philadelphia, have received orders for twenty locomotives for the Great Northern Railroad Company, of England, and twenty for the Choctaw, Oklahoma & Gulf Railroad in this country. The former order was placed by one of the directors of the English railroad company after a thorough inspection of the Baldwin works.

Messrs. W. J. Lewis and F. J. Wich, engineers for the English Linotype Company, are now in this country in quest of machinery, etc., for an additional plant which the company is to erect at its works at Broadheath, near Manchester, England. These gentlemen are staying at the Murray Hill Hotel, New York.

An electric railway which, it is stated, will be the first in Costa Rica, is about to be built in the city of San Jose by the Costa Rica Electric Light & Transportation Company, of that town. American material will chiefly be used.

Increase of manufacturing facilities during the last year has been very notable in the paper and the cement industries, many new mills being now in course of erection or but recently completed. It is therefore interesting to note the report that the Castalia Portland Cement Company is to erect a $250,000 plant at Castalia, near Sandusky, O. This implies that the boom of increase in the cement manufacturing line has not yet spent its force.

"The Columbia Automobile Company," capitalized at $3,000,000, has just been incorporated at Trenton. It is authorized to manufacture and operate vehicles propelled by electricity, compressed air or other power. Because of the close relations of one of the incorporators with the Pope Manufacturing Company it is suspected that the latter is behind the new concern.

POWER TRANSMISSION MATERIAL.

Advances in the prices of power transmitting machinery may shortly be expected. One of the most important local companies having been fortunate in securing raw materials before the increase in cost has been filling orders upon the old basis, but states that it is now only a matter of a few days before higher prices must be asked. At a neighboring office,

representing a company also influential as a market factor, information is given that they will withdraw all quotations early in April and make an advance amounting probably to 10 or 15 per cent. at least. The tendency of wood pulleys is uncertain. One party says that lower prices for them may be expected, owing to the expiration of certain patents in May.

EMERY WHEELS.

Emery wheel manufacturers, with not a known exception, are exceedingly busy. Some of them are considerably behind on deliveries of large wheels, including those of 16 and 18 inches diameter. One seller pronounces 12-inch wheels of certain grades also scarce. A local house about six weeks ago received an order for thirty-six large wheels for a locomotive and car shop in Europe, and it is yet unfilled. One of the oldest companies having a local office expects the sales of this month to exceed those of any other on record. Its business is chiefly from other districts. Another emery wheel seller observes that his present sales are made more particularly to manufacturers in regular lines than to jobbing shops. There seems to be little disposition on the part of emery wheel makers to stand out for better prices. Emery itself, however, has stiffened up and advances are gradually being made in corundum wheels. A dealer states that the latter are 15 per cent. higher than they were five months ago.

The American Emery Wheel Works, Providence, R. I., advise us that the foreign demand for their goods is active, the call for their wheels from England being constantly on the increase. From Germany they have recently entered an order for $8,000 worth of emery wheels and grinding machinery.

NOTES FROM CENTRAL WESTERN TOWNS.

Like other machinery manufacturing towns, Hamilton, O., is a hive of activity at present. The Hamilton Machine Tool Company is so crowded with work that it has in mind the extension of factory facilities. Its export trade as well as the domestic is heavy. The Niles Tool Works are rushed to utmost capacity and running overtime. H. G. Wallace reports numerous inquiries for his newly invented machine vise from Europe as well as from this country. It is to be placed definitely upon the market in a few days. Demand for gas engines, as experienced by the Advance Manufacturing Company, was never greater. Some are being shipped abroad. Hooven, Owens & Rentschler are turning away orders for the Hamilton-Corliss engine and are quoting prices for one day only. Long & Allstatter report a steady and well-maintained demand for their punches, shears and agricultural machinery. They are behindhand with orders and contemplate an increase of facilities.

The National Machinery Company, Tiffin, O., nut and bolt machinery manufacturers, is so flooded with orders that it is planning an increase of capacity. It is just completing an order for a large number of machines for the manufacture of railroad and other fencing.

Some of the Toledo reports are as follows: T. D. Keasey, maker of wood pulleys, has recently received orders compelling him to run his factory overtime. The Vulcan Iron Works are running overtime and complain of inability to secure the iron plates necessary for their operations. They have lately completed an interesting "steam" shovel, run entirely by electricity, one motor driving the car, another swinging the crane, while the third, mounted on the crane, operates the dipper. Baker Brothers are making an extensive addition to their foundry installation. The new factory at Westlake avenue is now almost completed and is working full blast.

The Fuller Company, of Detroit, Mich., is manufacturing a number of "air propellers" (i. e., blowers) for the Russian navy, to be driven by small upright 12½-horse-power engines. These "propellers" are 72 inches in diameter, with a special curve to the blades, the outer ends of which are bolted to a retaining ring of steel. A large number are also being manufactured to be electrically driven, the motor and fan being combined in one frame. The company has many orders for its staple work, that is, dynamos and motors, and is about to enlarge its factory.

CHICAGO MACHINERY MARKET.

The Chicago representative of a large emery wheel producer says that the sales which he has made during the first two months of 1899 exceeded his entire sales for 1898. March, so far, is ahead of February, though trade during the past two weeks has been a little slow as compared with the tremendous business of the previous two months. This is one of the ultra experiences in trade, although everywhere is heard corroboration that business is active and wholly satisfactory.

Bicycle manufacture is at the hight of the season. The sellers of some supplies to the large bicycle works say that the latter are beginning to shut down, having completed the bulk of their expected product for the coming year. But this condition does not seem to be general. There is, perhaps, a lull, awaiting the early returns of orders, which are rather slower than usual this year, because the makers of wheels have been selling more generally to the hardware trade and less through special agents. This change occasions a tardiness of orders. The smaller bicycle plants are becoming more active and they will continue in operation long after the large works finish for the season. Regarding the trade in bicycles this year, only one opinion has been encountered. It is that the sales will exceed those of any previous year.

Dealers in miscellaneous machinists' supplies say their mails now bring every day notices of advances in prices. Slowness in shipments from factory is increasing. Broken stocks are not at all uncommon. Agents of Eastern makers, who are supposed to keep a full line of goods in stock here, are sending a constantly increasing percentage of their orders to be filled from factory direct, the supplies not uncommonly being still further delayed until they can be manufactured. And dealers are buying very extensively in anticipation of an extended continuation of the present large demand. One of the largest dealers in this city has just returned from the East, where he has placed one of the largest orders for goods he has ever closed.

Manufacturers of transmission of power machinery are busy, or more than busy. The A. Plamondon Manufacturing Company report business booming. They are running full time and have many orders ahead. The W. A. Jones Foundry & Machine Company is running night and day, and is not only swamped with domestic orders, but has lately received a large inquiry from abroad. Shafting, hangers, pulleys and belting are going into all kinds of plants, large and small, new and old. The price of belting is firmer on account of the strength in leather, but has not yet advanced materially, although a rise in values would not be unexpected.

It is said that a number of manufacturers in the West, who have been figuring upon an extension of their plants by midsummer, will be disappointed in getting the motive power when wanted, having incorrectly surmised that boilers could be secured on three months' deliveries, as heretofore. The shortage in plates will prevent these deliveries.

It was stated in this column two weeks ago that the Quincy Mining Company, Hancock, Mich., purchased from the Ingersoll-Sergeant Drill Company a large air compressor. The Ingersoll-Sergeant Drill Company sold a large compressor to the Franklin Mining Company, of that place, but the compressor purchased by the Quincy Mining Company was made by the Rand Drill Company.

Quotations.

NEW YORK, Monday, March 27.

Iron—American pig, tidewater delivery:—

Pennsylvania irons:	
No. 1 X foundry	$16 75 @ 17 00
No. 2 X foundry	15 75 @ 16 00
No. 2 plain	15 25 @ 15 50
Gray forge	15 75 @ 15 00
Alabama irons:	
No. 1 foundry	16 25 @ 16 50
No. 2 foundry	15 75 @ 16 00
No. 3 foundry	15 25 @ 15 50
No. 1 soft	16 25 @ 16 50
No. 2 soft	15 75 @ 16 00
Foundry forge	15 00 @ 15 25

Bar Iron—Base—Mill price, in carloads,

on dock: Common, 1.48 @ 1.50c., nominally; refined, 1.58 @ 1.60c. Store prices: Common, 1.65 @ 1.70c.; refined, 1.75c, upward. The adoption of a new list of extras is reported, but it does not yet prevail in this market.

Tool Steel — Base Sizes — Standard quality, 6 @ 7c.; extra grades, 12 @ 14 c.; special grades, 16c. and upward.

Machinery Steel — Ordinary brands, from store, in small lots, 2.00c.

Cold Rolled Steel Shafting—Base sizes, from store in small lots, 2.75c.

Copper—Carload lots, Lake Superior ingot, 17¼ @ 17½c.; electrolytic, 16¾ @ 17c.; casting copper, 16½ @ 16¾c.

Pig Lead—Carload lots, 4.40c., f. o. b. New York.

Pig Tin—For 5 and 10 ton lots, 23⅞ @ 24c., f. o. b. New York.

Spelter—In carload lots, 6.35 @ 6.40c., New York delivery.

Antimony—In cask lots and over, 10 @ 11c., according to brand.

Lard Oil—Prime city, present make, 45 @ 46c. for a good brand, in wholesale lots.

The New Foundry of the General Electric Company.

March 24 was the occasion of a highly enjoyable excursion by about twenty representatives of various technical papers to Schenectady, N. Y., to view the new foundry of the General Electric Company. This foundry is one of the very finest and largest in the country. The building is of steel frame construction, with brick side walls—these walls being, however, curtain walls only and not structurally a part of the building. The following figures give the leading dimensions of the building:

Main building—140 x 503 feet.

Cleaning room wing—120 x 103 feet.

Large lean-to—38 feet 6 inches by 243 feet.

Small lean-to—11 feet 4 inches by 152 feet 4 inches.

Total floor area—93,900 square feet.

Hight of side walls—23 feet 9¾ inches.

Hight of gables (main)—58 feet 3 inches.

Hight of gables (wing)—51 feet 8 inches.

Hight of cupola room wall—28 feet 8 inches.

Cubic contents—3,250,000 feet.

Weight of steel—1,200 tons.

Cubic yards concrete—1,833.

Cubic yards stone—1,203.

Number of bricks—1,250,000.

Cubic yards filling inside—27,000.

Cubic yards filling outside—53,000.

Square feet of window surface—12,286.

Square feet of skylights—23,336.

Capacity of sand sheds—6,000 tons.

Capacity of coke shed—600 tons.

The foundry is fitted with three Colliau cupolas of 7, 11 and 18 tons capacity per hour, respectively, and has an equipment of ladles up to 15 tons capacity each, while the equipment throughout is complete and of the highest order. The most striking feature is the attention given to light and ventilation. Few foundrymen, we imagine, have ever seen so light a foundry—this feature being in accord with the most modern practice in machine shops, and the lighting effect being fully up to the best machine shops. The heating and ventilating is by the Buffalo Forge Company's blast apparatus, the air to be warmed being drawn from out of doors, while the discharge of smoke and gases is practically perfect. Another detail assisting in this result is the attachment of exhaust fans to the rumblers. The toilet facilities are likewise equal to the best shop practice—a large airy room being given to this purpose, an abundance of hot water being supplied, and several shower baths being included in the equipment. A complete set of lockers for the men's clothing is also provided.

The crane facilities are admirable and include a 40-ton, two 10-ton, one 7-ton and three 5-ton overhead travelers, and six 5-ton jib cranes. The jib cranes are movable—sockets for their reception being located on the various columns of the building—the plan being that the traveling crane shall place the jib cranes wherever they happen to be needed. Full crane facilities for the molders in various parts of the building are thus provided without encumbering the building with more cranes than are needed at any one time.

We hope to show in detail some of the equipment of this splendid foundry and some of the novel methods employed there in a future issue.

The Growth of the Navy.

The Fifty-fifth Congress authorized the construction of forty-eight war vessels, classed as follows: Six sea-going battleships, four monitors, three armored cruisers, six protected cruisers, sixteen torpedo boat destroyers, twelve torpedo boats and one gunboat for the Great Lakes. Three of the battleships are to cost $3,600,000 each, the other three $4,000,000 each, and the monitors $1,250,000 each; all exclusive of the cost of guns and armor. In addition to all these ships, there are now in course of construction, as previously authorized, five first-class battleships and one nearing completion for us in England; so that the indications are that we will one day have a respectable navy. We should certainly have a respectable repair shop to maintain all in high efficiency.

Test of a Safe.

Our readers who may remember our detailed description of how safes are opened by means of nitro-glycerine extracted from dynamite, and our illustrated description of the manganese steel safe made by Hibbard & Rodman, in issue of July 21, 1898, may be interested to know that on the 4th inst. one of these safes was tested at Albany, the severity of the attack upon it being agreed by disinterested and expert witnesses to be about twice as severe as any burglarious attack could be, and that the safe resisted absolutely. Nitro-glycerine and dynamite were exploded against it sufficient to have wrecked any building in which it might have been placed, and the only effect was to make an opening hrough the door where the locking spindle had been, through which opening a sufficient amount of nitro-glycerine could probably have been introduced to break the safe open, but as the charge necessary to have done this would have absolutely destroyed whatever the safe might have contained it was agreed to be useless to carry the test further.

In the factory of the Grant Ball Company, Cleveland, large quantities of oil and emery are used for grinding, and the oil finally becomes so thickened with particles of emery and steel as to make it of the consistency of mud. In the city where this material accumulated no other way of disposing of it could be found except to pay for its removal outside of the city limits, for it was of such a character as to make it practically impossible to dispose of it in any other way. Finally the managers hit upon the plan of running it through a centrifugal cream separator, which completely separates the particles of emery and steel and runs the oil out at a separate spout, so that it can be used over again, while the mixed emery and steel can be disposed of much more readily than when, as formerly, mixed with oil.

The following table of the boiling points of liquified gases at ordinary atmospheric pressure may prove useful for reference:

	Deg. Cent.	Deg. Fahr.
Sulphur dioxide	— 10	+ 14
Chlorine	— 33	— 27
Ammonia	— 38	— 36
Sulphuretted hydrogen	— 62	— 79
Carbon dioxide	— 78	—108
Nitrous oxide	— 88	—126
Ethlyene	—102	—151
Nitric oxide	—153	—243
Marsh gas	—164	—263
Oxygen	—183	—297
Argon	—187	—304
Carbon monoxide	—190	—310
Air	—192	—314
Nitrogen	—195	—319
Hydrogen	—238	—396

Inquiry for Machinery.

(99) Machines for boring sections of boilers for house heating.

The time for the coming spring meeting of the A. S. M. E., at Washington, has been fixed for May 9 to 12.

A New Turret Lathe.

The accompanying engravings illustrate a machine which has been designed as a further step toward doing by turret tools, at a relatively very rapid rate, work which it was formerly considered possible to do only in turning lathes. With the ordinary turret machine, the number of duplicate pieces to be made at one time, or at one "setting up" of the machine, must be considerable, but by constant improvements the dividing line between the number of pieces that can profitably be made at one time upon a turret machine and the smaller number which cannot be so made has been steadily shifted in favor of the turret and the present machine, by its new form of turret, and the character of the tools which it permits the use of, renders it possible to make advantageously a much smaller number of pieces than could be economically made upon a machine with the common form of turret and tools. Besides this, it admits of work much longer than usual being advantageously handled.

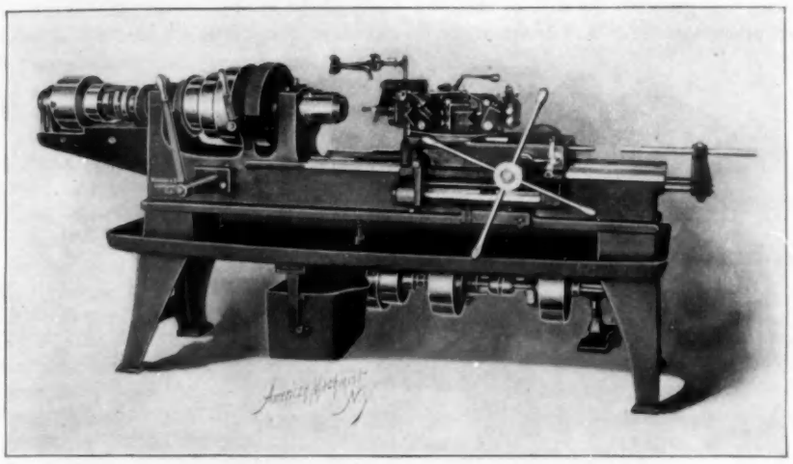


FIG. 1. HOLLOW HEXAGON TURRET LATHE.

Though the machine will be seen to possess other notable features and to be particularly neat and elegant in design, we pass at once to the turret, which is the principal novel feature. This turret, which is best shown in Fig. 2, is hexagonal, and instead of being made practically solid, as usual, has its sides about 5/8 inch thick, and the interior space is entirely open and accessible. Holes of large diameter are bored through the sides of the turret as usual, but these are not used in the ordinary manner. They serve only to center or locate the various tools, which are fastened to the faces of the turret and are clamped tightly to them by bolts introduced from the rear, and which engage with tapped holes in the tools. A short boss is turned on each tool to fit the turret holes, and the boss simply locates the tool and prevents its displacement.

By this method of fastening, tools of a character that makes them practically impossible with the ordinary form of turret are made available, these tools being much more readily "set up" or adjusted to a given job, and much more completely universal in their range of application to different jobs than the ordinary turret lathe tools can be.

The cutting tools, as Fig. 2 shows, are forged and ground much the same as ordinary lathe tools, and are moved to or from the work by the small ball-ended lever shown, which turns an eccentric in a slot and thus swings the tool in or out, the tool holder being pivoted upon the large screw, the head of which is seen below the tool. Fine adjustment for exact size of the work is made by the horizontal screw behind the cam lever and near the top of the turret, this screw being fitted to move a sliding piece to which the previously mentioned cam is attached.

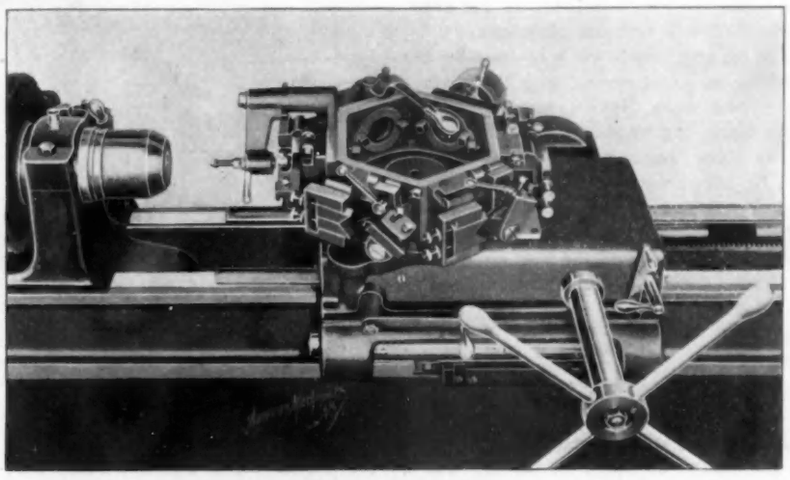


FIG. 2. VIEW FROM ABOVE AND FRONT OF HOLLOW HEXAGON TURRET.

Opposite each tool is a back-rest which, as shown, consists of two separately adjustable pieces, so shaped that their inner ends form a V, in which the work is supported and held up to the tool.

In Fig. 2 the stop is shown in position to gage the length of the piece as the bar is automatically fed forward. It swings downward into position, and when turned upwards leaves the first tool unobstructed and ready for operation, this removal of the stop being effected by the small lever shown, which first rotates a cam that causes the gage-screw to recede and thus frees the stop for removal. As shown, the machine is set up for turning a piece having four different diameters, or three shoulders, and for threading and cutting off.

In order to secure the greatest possible strength and rigidity without unnecessary weight, the turret is a steel casting. Its sides, being tied together, are, of course, very rigid, and when indexed to a given position it is clamped to its seat by a hook bolt, which takes hold of it near its periphery and directly under the tool being used. This clamping bolt is operated by the lever at the side and near the front end of the saddle and shown in the loosened position in Fig. 1 and in the clamped position in Fig. 2.

The feed is by means of a rack which is placed in the middle of the bed, where it can exert no twisting force upon the saddle, and the turret is automatically rotated and indexed by what looks like a stop at the rear. It is in fact a stop, but its purpose is to prevent the further rearward movement of the stud seen projecting from the rear of the saddle, and when this is thus arrested the continued motion of the saddle to the rear operates the unlocking, indexing and re-locking mechanism under the turret.

The arrangement of the stops for limiting the advance of the various tools is also new. In a machine of this character there must be six stops, each independently adjustable, because the tools are not adjustable in line with the axis of the work, and yet must be advanced to widely different yet accurately predetermined positions. This is accomplished in this case by providing a rotating bar, which is seen below and

in front of the saddle. Lengthwise of this bar six T-slots are milled, and by means of these slots stops are secured to the bar so that they may readily be adjusted lengthwise to any desired position. The turret and this bar are geared together by a compound train of spur and a pair of bevel gears, so that, as the turret rotates, the bar must also rotate through the same arc, and thus a given stop on the bar is always in position to arrest the further movement of the saddle when its particular tool has advanced to the predetermined point.

Two stops are attached to the bed, as shown, one of them projecting upwards further than the other, and some of the stops on the bar are so short that they will engage only with the longer one on the bed, passing over the other one, and thus shoulders separated from each other nearly or quite 24 inches (the full capacity of the machine) are provided for by a stop-bar of only about half that length.

At the rear of the head-stock (which is cast solid with the bed) is the automatic feed arrangement, which consists of two rollers which are upon transverse axes and are rotated by worm gearing and small friction disks, which are driven by bronze rings; the principle being the same as in the well-known Sellers friction feed-drive. The bar passes between the two first mentioned disks, and is by their rotation fed forward until it meets the gage stop. A single lever (pivoted at the side of the bed, below the head-stock) opens and closes the chuck and throws this automatic feed into and out of action.

The rate at which work is done by the machine varies of course with the character of the work, but, as compared with lathe work, the time required for centering is saved, and on most pieces the cut can be taken much faster because work and tool are much better supported and tied together; and, provision is made for copious lubrication of the cutting tools.

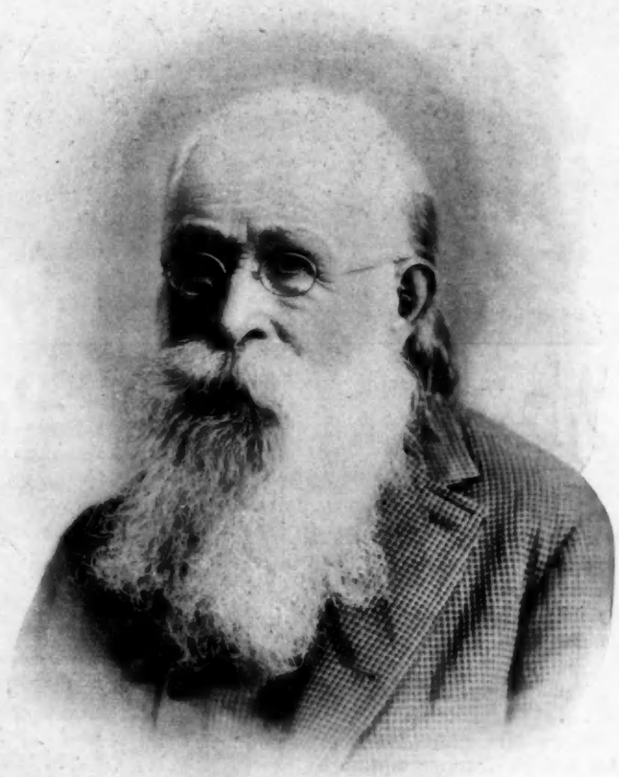
The machine is intended for work up to 2 inches diameter, 24 inches long, and is made by Warner & Swasey, Cleveland, Ohio.

George Escol Sellers.

During a period extending from 1884 to 1895 there appeared in this journal a series of articles (numbering nearly forty) entitled "Early Engineering Reminiscences," written by the subject of this sketch, who died at his home in Chattanooga, Tenn., January 1. These articles were remarkably interesting, and showed that their author had not only enjoyed a wide experience, but that his memory was remarkable, and that from an early age he had been able to observe accurately and to understand the reason of things.

We give a portrait of him, made from a photograph taken a short while before his death, and the following sketch of his career:

George Escol Sellers was born in the city of Philadelphia on November 26, 1808, so that at the time of his death he was 90 years 1 month old. He was the second son of Coleman Sellers and Sophonisba Peale, and in view of his ability as an engineer, it is interesting to note that his progenitors were men of marked inventive and mechanical skill for five generations to his paternal ancestor, Samuel Sellers, who settled in the province of Pennsylvania in 1682. On his mother's side he came of Maryland stock, and was a grandson of Charles Willson Peale, the celebrated naturalist and portrait painter of the revolution. His grandfather, Nathan Sellers, was probably the first to manufacture paper molds as a distinct trade in the country, and was the founder of the firm of Nathan & David Sellers, so long identified with wire-working and the manufacture of paper-making machinery. It was the pioneer work of this concern that furnished much of the interesting material for Mr. Sellers' engineering reminiscences referred to above.



GEORGE ESCOL SELLERS.

After completing his education in private schools in Philadelphia, he entered the employ of his father and grandfather, the firm of Nathan & David Sellers, where his elder brother Charles was also engaged. Upon the death of Nathan Sellers, in 1830, the business was reorganized, Coleman Sellers and his two sons thereafter conducting it under the firm name of Coleman Sellers & Sons. They established themselves in new shops located near the city, where, in addition to the improved paper-making machinery which they had designed, they engaged in the manufacture of hand cards, card clothing and carding machinery. The facilities offered by these works were such as to induce the firm to undertake contracts for locomotives, resulting in their building the first engines of this kind equipped with forged frames, and they were also called upon to construct machinery for the United States Mint. About this time the death of Coleman Sellers placed the entire business of the new concern in the hands of his two sons, and this being followed shortly after by the financial depression of 1837, the firm, like many others, was obliged to suspend.

After closing his affairs in the East, Mr. Sellers removed to Cincinnati, where with his brother Charles he established a factory for making lead pipe from fluid lead, under patents which had been granted to him for that invention. This business was eventually sold to a company controlling the lead-pipe industry, and associating with Mr. Josiah Lawrence, a merchant of Cincinnati, Mr. Sellers organized the Globe Rolling Mills & Wire Works, where he introduced improved machinery of his own design. Subsequently he disposed of his interest in this

enterprise, and in 1850 and 1851 undertook the manufacture of locomotives for the Panama Railway, having invented and patented a locomotive for use on heavy inclined planes. For some years he was engaged in the manufacture and sale of locomotives and machinery, but eventually became interested in mining operations in Southern Illinois, where the remainder of his active business life was spent in pursuits which not only presented a wide field for his inventive ability and experience as an engineer, but also gave him an opportunity to indulge his deep interest in archæological research. He contributed a number of papers relating to the relics of the mound builders in the neighborhood, including one published by the Smithsonian Institution at Washington, relative to the aborigines' method of making earthenware salt pans as found *in situ* near the salt springs of Southern Illinois. He described also the process of making the arrow-heads and implements of the stone age.

Upon his retirement from active life, Mr. Sellers removed to Chattanooga, Tenn., where, having secured a home for himself on Mission Ridge, he spent the remainder of his life among congenial and appreciative friends. It was from this Southern home that he contributed his engineering reminiscences to the "American Machinist." Beside his mechanical ability, Mr. Sellers had from his early boyhood a decided taste for art, and possessed no little skill as a painter. This talent was doubtless cultivated and encouraged through close association with his grandfather, Charles Willson Peale, and his uncle, Rembrandt Peale. When he was but sixteen years of age, Thomas Sulley, the artist, recognizing his ability, urged him to adopt portrait painting as a profession, and offered to take him as a pupil. Although his decided taste for mechanics determined his course of life, he always remained in touch with art, and counted among his friends many of the prominent painters, draftsmen and illustrators of the day. Although feeble in body, Mr. Sellers' mental faculties were but little impaired by his advanced age, and he contributed many interesting pages to his personal memoirs until within a very short time of his death.

Patterns for Crane Cheeks—II.

BY JOSEPH HORNER.

Fig. 5 shows the pattern for one of the cheeks for a double-geared hand winch of common type, *A* and *B* being alternative forms of section through web and ribs. It is properly made of cast iron, because such winches are required in large numbers and kept in stock, and as the metal is light everywhere—often not more than ½ inch—a wooden pattern could not be made strongly, nor kept permanently true. For an odd order, or for a winch of special character, a wooden pattern can be framed together with halved joints and fillets, divided into short lengths and glued. But this is not suitable for standard use, unless special rigs-up, to be noticed presently, are adopted for the purpose, affording adequate support to the pattern, and even then the strength and durability of a metal pattern cannot be equalled in wood.

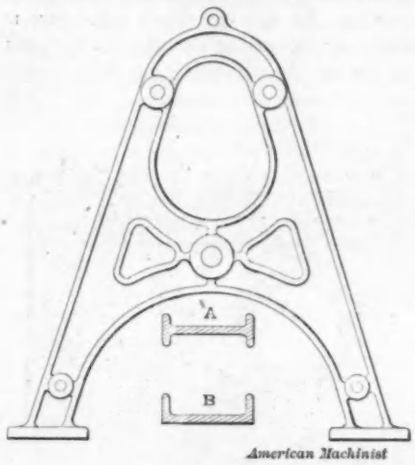


Fig. 5

Fig. 6 shows one of the cheeks for a hand crab, which travels on a gantry, formed of two supporting girders, with rails. Here the casting is solid plated, save for the two lightening holes cut in the neutral plane. Such a cheek would range from about 4 to 7 feet long, and its thickness from ⅞ to 1¼ inches. Such a pattern would be heavy if made in iron. It might be framed together in the manner shown in Fig. 7, filling in the central portion with a loose, removable piece. And this would be the best method of constructing such a pattern.

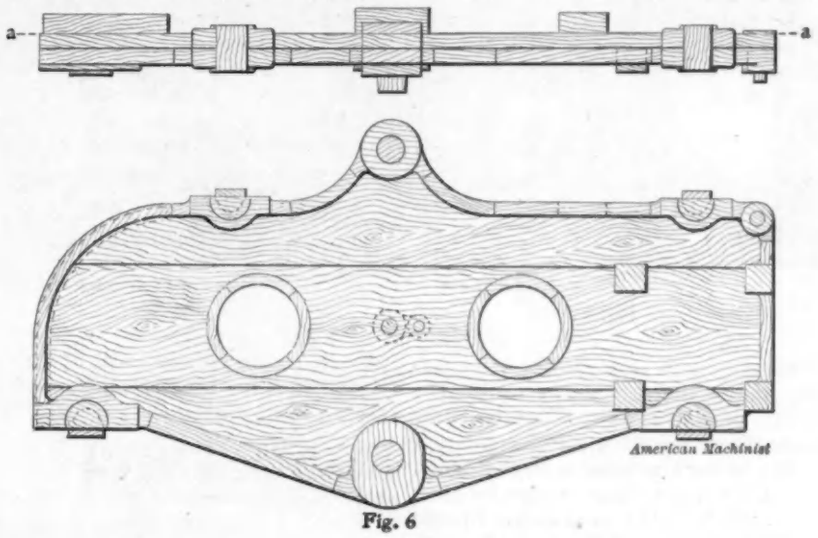


Fig. 6

But it is seldom that jobs of this character are absolutely standard and made in considerable numbers, like cranes and winches. The usual method of making patterns of this type is that shown in Fig. 6, with open joints. Such a joint is shown enlarged in Fig. 8. It may be ⅛ inch open. It is dowelled tightly, and ribs are made to cross it whenever practicable. Still, in such a job as this, the frame cannot be maintained flat and rigid unless reinforced in some other way. A frequent practice is to screw battens temporarily on the top face in the mold, in order to maintain the pattern true during ramming, and then stop up their impressions in the mold, or take them off the pattern before the mold is finished. Fig. 9 shows such a temporary batten *A*, screwed on an open-jointed pattern. Such battens are made as deep as practicable, so that they may not be curved themselves by any curving of the pattern. Bars in the cope may come in the way and necessitate their being cut down. The screws are put in from the top, so that they can be removed before the lifting of the cope, which would tear up the sand from a deep batten made fast to the pattern.

Fig. 10 illustrates the pattern of one of the cheeks which is bolted on the timber jib of a wharf crane to carry the gearing spindles. Such cheeks will range from about 2 feet 6 inches to 3 feet 6 inches in length, and their pattern webs are either made of a single solid piece of stuff or with open joints. In these also the web will curve unless stiffened with temporary battens or rammed on a level bed.

The flimsy character of much pattern work of this type renders it desirable to have a large stock of well-made bottom boards, or turn-over boards, and match plates in the foundry of a crane shop. There will be many flasks in the foundry made specially, and used for standard jobs. Each of these flasks should have its bottom board. This practice secures at once a wide range of flasks and bottom boards adapted for odd work as well as for standard. And so, however flimsy a pattern may be, it can be rammed truly upon the bottom board of the flask in which it is molded without any trouble with the stopping-off of battens.

As it is not permissible to cut recesses

in standard bottom boards to receive projecting bosses, fillets, etc., on jobbing work, all these extraneous attachments must be left loosely dowelled on the back or top face of the pattern. This is generally so much the better for the molder, and also avoids the cutting of recesses in the board. In standard boards, made and kept wholly for standard jobs, of course there is no objection to such cutting-out being done

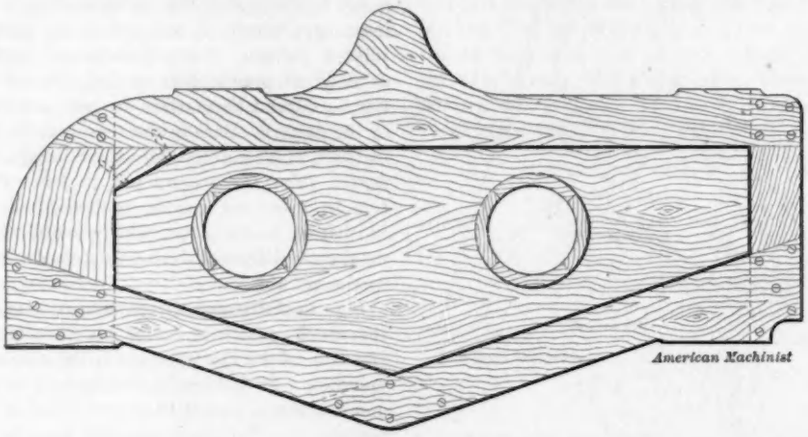


Fig. 7

on the boards, and it is preferable in such cases to cut recesses for shallow pieces, rather than to leave them loose. But it is better for the molder always to make deep parts, say of over ¾ inch or 1 inch deep, loose, in almost any case.

If a pattern like that in Fig. 5 is made in iron, a bottom board is not necessary; but if made in wood, a bottom board is

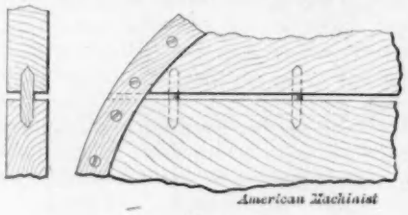


Fig. 8

essential, both to avoid damage to the pattern and to ensure a level casting. The section of such a cheek might be either *A* or *B*. The single-ribbed section *B* would lie very well on a bottom board, except for shallow boss facings for shaft holes, which could be left loose. But the double-ribbed form *A* would not lie thus, unless the board were recessed to the termination of the rounding edges. And in many cheeks of other types there would be deep bosses or brackets, or ribs standing at hights not uniform. Hence for standard jobs it is often the practice to make two distinct bottom boards, one to take all the parts of the pattern belonging to one portion of the mold, the other to take the whole of the supplementary parts, and the faces of the boards then coincide with the joint edges of the flasks. The joint faces of the mold may not always coincide entirely therewith, because portions of those faces where down-jointing occurs may be formed by blocking up or by recessing certain portions of the boards. In such cases the cope is rammed on one board and the drag on the other board, and the two flasks are not brought together until they are finally closed for pouring. In such cases very great care is necessary in setting the various portions of the pattern accurately on each board, so that there shall be no lapping joints or fins in the casting. The flask parts are guided to and retained in correct positions on the boards by means of either of their pins entering into the holes in the bottom board or by means of corner blocks or clips fastened on the board.

From the employment of two separate bottom boards for cope and drag, respectively, to that of a single match-plate fitted to both cope and drag is an easy stage. In this method the two portions of a pat-

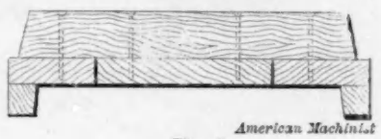


Fig. 9

tern are put on opposite sides of a single plate, which lies between cope and drag, and on which each flask is rammed. On

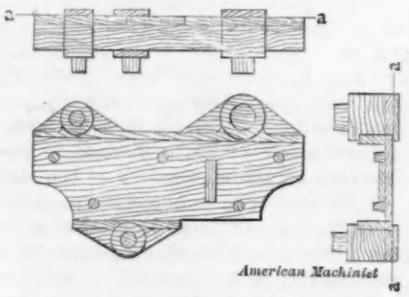


Fig. 10

the withdrawal of the plate and pattern parts, the cope and drag are brought together and closed for pouring. In this case the same precise care is necessary in fitting the two portions of the pattern on opposite sides of the plate, as there is in the case of two bottom boards. But there is rather less risk of inaccuracy, and a single plate suffices. This method is well suited to cheeks of the form and type shown in Figs. 5, 6 and 10, and to many others. Owing, however, to their dimensions, iron match plates are not used, but plates of wood, like Fig. 11. These are made of two thicknesses of narrow strips crossing one another at an angle, and well nailed together. In the largest plates three thicknesses may be employed. The strips of wood are well bound down the edges with strips of stout hoop iron, rabbitted in and screwed.

In Figs. 6 and 10 the plane *a a*, which coincides with the top plane face of the pattern, coincides also with the joint faces of the turn-over board or match plate. So that the whole of the pattern which lies on one side of that plane *a a* goes on one board or face.

Of the methods described in this and in

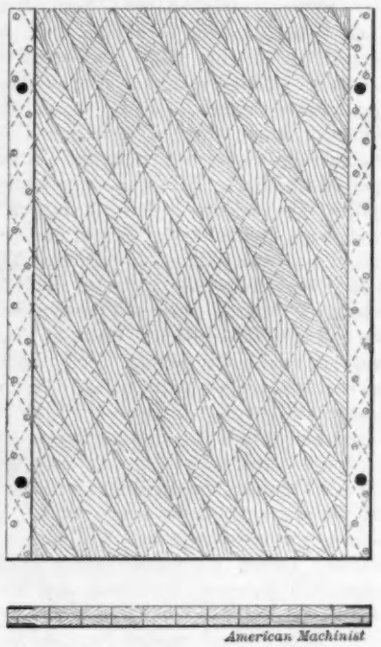


Fig. 11

the previous paper, each is better adapted to some jobs than the others, and the exercise of the foreman's judgment must settle all questions of this kind. The use of the match plate in Fig. 12 makes a very good job in all patterns of flimsy frames. But it is rather expensive in first cost of fitting up, and should be reserved for work of which large numers of similar castings are required. It is suitable for frames and cheeks of all classes, except the largest of all, for which the method of molding described in the last paper is to be preferred. Since the plate is clamped up close to the joint edges of the flasks, it is not necessary to make it of great thickness. From 1¼ to 1½ inches is thick enough for the largest plates. As the strips are so narrow, the risk of shrink-

age and swelling is practically *nil*. Such plates may be employed not only for special jobs, but a few may be kept in the foundry, like the bottom boards, for temporary use with jobbing work.

Either type of frame might also be molded upon the bottom board. But, having flasks with planed edges, it is not necessary to use a cumbrous board with the largest frames. In the case of the very light ones, however, the use of the board saves trouble, and protects the patterns from damage. The boards may not only be used to lay patterns upon, but patterns can be fitted on pairs of boards in a temporary fashion for the molding of, say, a dozen sets, to be removed when done with, so as to set the boards free for other work. In this way the total number of boards in a foundry is prevented from accumulating excessively, while pattern parts can always be replaced on an old board, if their location is properly marked and stamped.

To find the number of gallons delivered per minute by a double-acting pump at 100 feet per minute piston speed, square the diameter of the water piston or plunger and multiply the result by 4. This gives a result less than 1 per cent. greater than the full displacement. It might generally be well to use a multiplier a little smaller, say, 3.5 or 3.8, which would give some allowance for slip, leakage, etc.

A Variable Volume Constant Speed Air Compressor.

The half-tone gives a clear view of an interesting air compressor, the specially noticeable feature of which is in the means adopted for regulating the volume of air compressed. It happens in nearly all compressed-air service that the volume of air required for use varies continually, sometimes more being required and sometimes less. The compressor, if there is sufficient power available, must of course be capable of supplying the larger demand, and then when a smaller volume of air is required it becomes imperative to reduce the output to meet the reduced requirements. There are various ways of doing this. The most common way, probably, is not to do it; that is, the compressor is allowed to run at constant speed, using full power and delivering its full quota of air, which then blows away at the safety valve of the receiver. This means a great waste of power, unnecessary wear of the compressor, and abnormal and highly objectionable heating of the air in the receiver. Another way is to still let the compressor run at a constant speed, or nearly so, and then when air is not required, to allow it to play back and forth under the receiver pressure from one end of the air cylinder to the other. This results in heating the air cylinder and does not secure a good regulation of the air supply, because the air for any given stroke, or succession of strokes, is either compressed and delivered or it is not, and there is no intermediate reduction of work. The load is intermittently either all on or all off, and the transitions from the one condition to the other are sudden and the strain to the machine is severe. There is of course some saving of power by this arrangement, if the small-volume requirement is sufficiently frequent. Another and more obvious, and, at first sight, apparently more satisfactory, way of changing the air supply is by changing the speed of the compressor. This in practice is found to be not so easy a thing to accomplish, and at best it is limited in both directions. A compressor cannot usually be run very slowly on account of the inertia required in the moving parts to complete the stroke and to carry surely over the center, and of course there are sharp limitations to the speed in the other direction. With several of the different means of power development and transmission the sufficient change of speed is to say the least, inconvenient, and generally it is impossible. With air compresing cylinders attached tandem to the steam cylinders of a regular Corliss steam engine, or with a compressor driven by a water wheel, the permissible range of speeds is so narrow that it is scarcely worth while to change the speed at all, and usually it is not attempted. Where an electric motor with alternating current is used, it is imperative to run the motor and

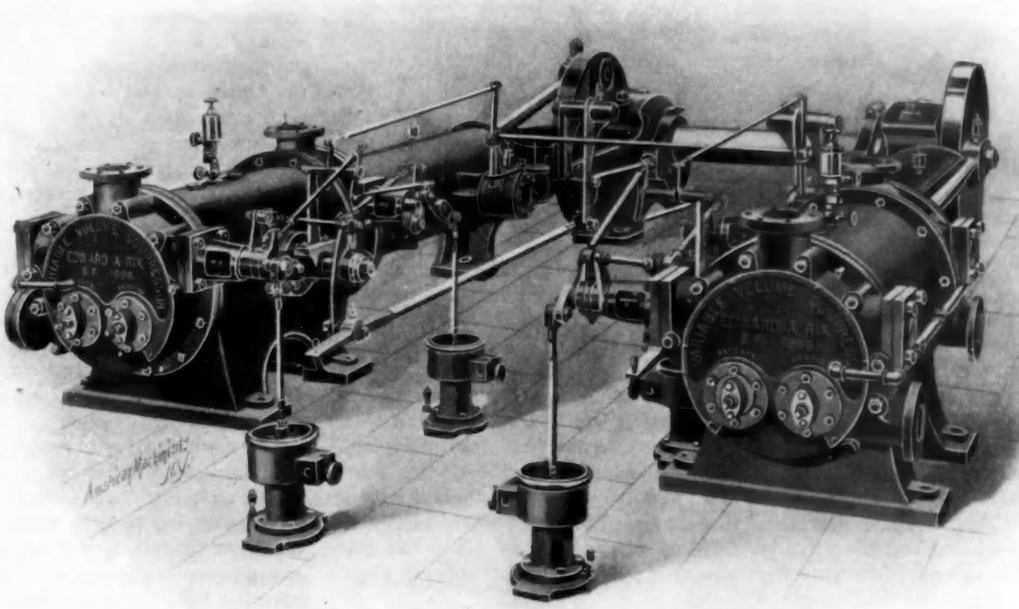


FIG. 1. A VARIABLE VOLUME AIR COMPRESSOR.

compressor at a constant speed in synchronism with the generator.

This matter was very fully and ably discussed by Mr. E. A. Rix, in our issue of November 10, 1898. In the paper referred to he not only showed the requirements of the case, but also his arrangement for completely satisfying them. This was described in a single sentence: "I accomplish this by so constructing and operating compressed air engines of th. double-acting type that the volumetric capacity of the cylinder can be varied by changing the point of closing of the induction valves in relation to the stroke of the piston, so as to entrap and compress the volume of air required for use, and no more, thus producing a constant pressure and a variable volume while the piston is moving at a uniform speed."

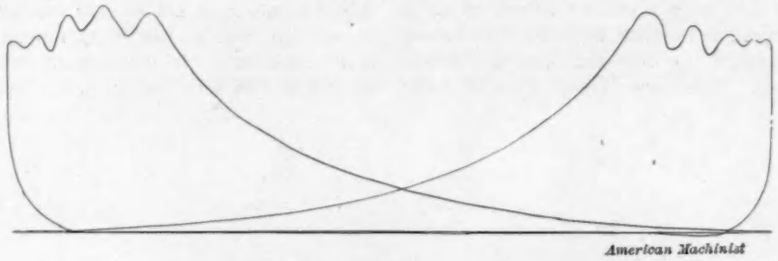


Fig. 2

COMPRESSING FULL STROKE.

The compressor shown in the half-tone is one of those built by Mr. Rix, embodying this principle. With the delivery valves we have here nothing to do, as they are not essentially different from many others in use. The inlet valves accomplish the entire effect desired. These valves are of the Corliss type, both as to the valves themselves and in the mechanism by which they are operated, the only difference being that the valve is released and closes upon the return stroke, and not upon the stroke for which the valve is normally opened for admission. The valve of either end is always open for the entire intake stroke, and if the pressure in the receiver is below, or not above, the normal the valve closes precisely at the end of the stroke, and the entire contents of the cylinder are compressed by the return stroke of the piston. If, however, the pressure in the receiver has risen slightly above that required, the valve does not immediately close, but allows some of the previously admitted air to escape again. The valve remains fully open, so that the air flows freely and with a minimum of resistance. At a certain point, self-determined by the mechanism, the valve is released and closes sharply, when the air then remaining is compressed and delivered, precisely the same as a full charge would be compressed. Fig. 2 is a double indicator diagram showing the compressor working to its full capacity. Fig. 3 is a diagram from one end of the cylinder only, showing the successive reductions of volume compressed for several strokes of the compressor. As the variation of pressure is never sudden or instantaneous, but always gradual, so the changes in the volume admitted to the cylinder are always thus graduated, and are never characterized by sudden and extreme changes of load. The diagrams here shown are reproduced full size from the actual indicator cards, the scale being 80. The cylinders of the compressor are 15 inches diameter by 30 inches stroke, making 80 revolutions per minute. On the main shaft there is a 14-foot band wheel (not shown in the half-tone), carrying a 24-inch dynamo belt. The driving motor is a 150 horse-power Westinghouse induction motor. The action of the machine is fully up to expectations. It drives principally a 75 horse-power hoisting engine in the Jumper Mine near at hand, together with a number of rock drills, and it will also furnish power for another hoisting engine about 4,000 feet away. The air is compressed to 90 pounds, and delivered into five receivers, 48 inches in diameter by 20 feet long. From these the portion which actuates the hoisting engine passes into a steam boiler of about 50 horse-power. The air is led in an independent pipe down through the steam drum and through one of the boiler nozzles to within about 3 inches of the surface of the water, allowing the air to impinge upon the surface of the water and spread out, giving it in that way an ample opportunity to absorb the heat and moisture. It is found from actual results that it takes about eight cords of pine wood per month to do the heating, which is about a quarter of a cord of wood per day. This wood is mountain pine, and it possesses a power capacity of about 13 horse-power per 24 hours, with ordinary slide-valve engines. From the small amount of wood used, it will be noted that there is no active firing done under the boilers, merely enough fire being introduced to maintain itself. The ash-pit doors as well as the furnace doors are always closed. Three or four sticks of wood placed on the fire every four hours are sufficient.

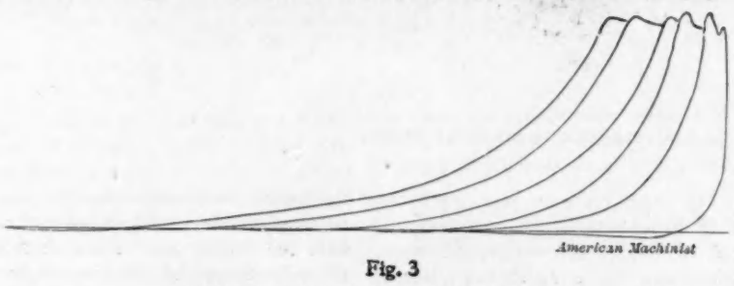


Fig. 3

COMPRESSING DIFFERENT VOLUMES.

The feed pump is only called into service once or twice during the 24 hours.

One great value of this kind of service for hoisting engines is not only that it is economical on account of the intermittent work which a hoist has to perform, but the large storage capacity, which backs up the boiler, enables the hoist to be made with a variation of only 2 or 3 pounds pressure, thus permitting the link to be brought into play on the hoisting engine and giving quite a little expansion advantage.

It may be thought that there is some danger in mixing the air with the steam, but there is none. The air valve has been opened, establishing connection between the receivers and the boiler, when there was 90 pounds steam pressure on the boiler, with no vibration or injurious action of any kind.

The compressor operates to perfection, the dash-pot cutting off as nicely and clearly as in any Corliss steam engine, and there never has been in either of the two machines of this type now in operation any air ever delivered out of the safety valve of the receivers, which shows that whatever power is expended upon the compressor goes for useful work. The variations of pressure are very slight, being all between 90 and 94 pounds.

In Fig. 3 the delivery line has not been very perfectly reproduced by the engraver, but it will suffice. If any computation is attempted with these successive cards, Fig. 3, it must be remembered that they are each of a different length, and not all of the full length of the longest or full stroke card. The right hand or delivery ends of the cars, are, of course, coincident, but the compression in each case of course begins at the point where the compression line begins to rise above the atmosphere line.

The areas of the inlet valve openings in this compressor are about 8 per cent. of the piston area, which gives a free opening. In larger compressors the inlet area has been made as much as 10 per cent. The valve mechanism used in this compressor is, of course, of most value where the compressor must run at constant speed,

although with any style of machine it is valuable for maintaining the pressure with the smallest possible variation. This compressor was built by the Rix Engineering & Supply Company, San Francisco, Cal.

An Air-Chamber Charging Pump.

BY WALTER FERRIS.

Two globe valves, two check valves, some pipe and fittings and a very moderate amount of labor can be made into a little water-piston air pump, such as is connected to the end of the water cylinder of the boiler-feed pump shown in the figure. It is only necessary to tap a ½-inch or ¾-inch pipe connection into one of the water cylinders of any pump, put in a nipple and valve, and carry the line from the valve to a point several feet above the suction level. There attach the air pump consisting of a vertical piece of, say, 2-inch pipe, a foot long, with a tee on top. The air-suction pipe *a*, with an inward-opening check valve, is placed on one end of the tee, with delivery pipe *b*, and an outward-opening check valve, on the other end. The top of the tee is provided with a pet cock.

Before passing on to the uses and usefulness of the air pump, it will be well to say something about its operation. There are some points about this which need to be carefully considered before locating it, in each particular case. The piston of this air pump consists of a column of water rising and falling in the chamber *C* on account of the alternate sucking and expelling action of the plunger in pump-cylinder *E*. In order to pump air successfully, especially at high pressures, this water piston must rise far enough at each stroke to completely fill the pump up to the check valves, and drive all the air out through the delivery-check. If any quantity of compressed air is retained in the tee and connections at the end of the delivery, no more air can be drawn in through *a* until that already in the pump has expanded down to atmospheric pressure. So the water piston must fall far enough at each stroke to allow the air contained in any clearance spaces to expand, and to draw in more air besides.

Practically, the air pump must be so located that more water will enter it at each delivery stroke than is drawn back again into the main pump during the suction stroke. This excess water is, of course, delivered by the air pump, together with the air. This condition of location requires that the hight *h* between the air pump and the water pump shall not exceed the head *H* due to the delivery pressure of the water pump; because the head *H* causes the outward flow of water from the cylinder *E*, while *h* causes the inward flow. If *h* is in excess, the water in *C* will gradually fall away from the check valves, followed by air taken in through *a*, but not forced out again; and the pump will fail to work. It is only in rare cases of low delivery pressures that failure from this cause need be guarded against. For example, in applying the air pump to a boiler-feed pump delivering against 100 pounds, the air pump would have to be more than 200 feet above the water pump to cause this kind of failure.

On the other hand, the air pump may fail if placed so low that the plunger in *e* finds it easier to draw water through the suction valves of the water pump than through the air pump. The reverse must be the case; and, to assure this, it is only necessary to place the air pump several feet above the suction level of the water pump. Hence the location of the air pump must be above the suction level and below the equivalent discharge level of the pump which actuates it. The ideal situation is half-way between these levels, and if an attempt is to be made to deliver dry air, it must be so located. But it is doubtful whether the result would be satisfactory.

The use to which I have applied this pump is the charging of air chambers. It is also used in connection with elevator pumps for charging the air-pressure tank from which the elevator cylinder draws its water; but as I have not seen it or any other appliance used in common engineering practice for controlling the volume of compressed air present in the air chambers of pumps and pipe lines, I think it worth while to call attention to its benefits. The air chamber itself has an assured place in connection with pumping machinery; yet its usefulness would be greatly increased in cases of high pressure, especially if it were filled with air instead of being only one-sixth or one-eighth full.

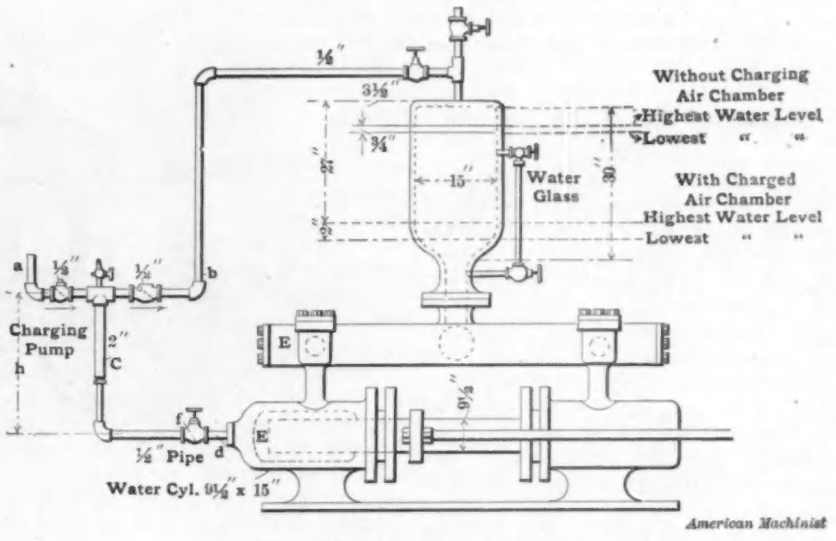
The necessary amount of fluctuation in the rate of delivery at different parts of the cycle of a duplex pump cannot be accurately calculated. Such a pump accommodates itself to circumstances. If the air chamber is not charged under pressure, it will contain only its own volume of free air, which we will assume to be equivalent to a cylinder 15 inches diameter and 30 inches high, at the atmospheric pressure of 14.7 pounds per square inch above a vacuum. This amount of air, when compressed by the water rising in the chamber, to a pressure of about 115 pounds per square inch, absolute, will occupy only about 3⅞ inches of hight in the top of the chamber.

$$(30'' \times \frac{14.7}{115} = 3.84'').$$

The volume occupied by this compressed air is then only about two-thirds of the displacement of one plunger, while the mean gage pressure is about

$$\left(\frac{30}{3.84} \times 14.7\right) - 14.7 = 100$$

pounds per square inch. If the pump be running even at the slow speed of forty single strokes per minute, the fluctuation in this water level will probably be at least ¾ inch, corresponding to a variation in gage pressure of 25 pounds, and accompanied by a sharp jumping of the gage pointer.



AN AIR-CHAMBER CHARGING PUMP.

If on the other hand, as shown near the bottom of the air chamber in the same figure, the volume of compressed air is about five times the plunger displacement, the fluctuation might be about 2 inches, the variation in pressure about 7 or 8 pounds, and the gage pointer would move quietly over its range. These figures were not arrived at by any deep mathematics, but by watching the pump. The advantages indicated are not small and unimportant, or interesting on paper only. They are: Less trouble with joints; less hammering; less swaying and jumping of pipe lines, with less necessary clamping and bracing; longer life of pump packing, pump valves, and pump itself. These results are, I think, well worth the small investment necessary to get them.

We have recently installed a Worthington duplex triple-expansion pump, with

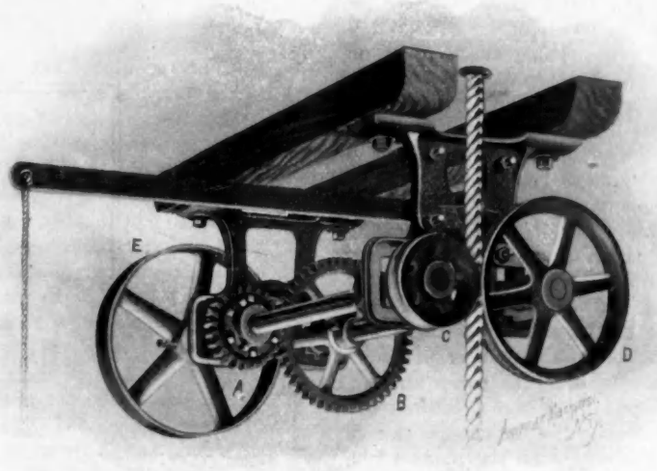
steam cylinders 8 inches, 12 inches and 20 inches diameter; plungers 9½ inches diameter; stroke, 15 inches. It is used to feed twenty-eight boilers of about 5,000 nominal horse-power, located in two houses 800 feet apart. The pump was not supplied with an air chamber, perhaps because a feed pump was expected to have a short delivery line. When first started up, pumping through one 6-inch pipe 400 feet long, at the very moderate speed of forty to fifty single strokes per minute, it shook the pipe line so violently that heavy bracing failed to keep it quiet. An air chamber, consisting of a piece of 10-inch pipe, 8 feet long, was then put on the delivery pipe near the pump. This was a great improvement, but the water rose to a foot from the top of the chamber, where it fluctuated about 1½ inches in level, while the gage on the pump jumped over about 20 pounds. After connecting an air pump, as shown in the figure, the water level was forced down to about 6 feet from the top, and the pump now runs without perceptibly moving the delivery pipe, with about 4 inches fluctuation in water level in air chamber, and about 6 pounds variation on the gage.

Compressed Air at the Franklin Institute.

An interesting meeting of the Franklin Institute of Philadelphia occurred on the evening of March 9, the topic of the evening being the recent applications of compressed air. The opening speaker was W. L. Saunders, C. E., vice-president of the Ingersoll-Sergeant Drill Company. He gave a little sketch of the history of the employment of compressed air, and a remarkable, and, to those not somewhat familiar with the subject, an astonishing enumeration of the present specific uses of it, concluding by calling attention to the vast contributions to the wealth of the world which have resulted from its employment in mining, the enlargement of the possibilities in engineering work by the use of air in driving tunnels and in sinking caissons for bridges and buildings. The ease with which rock is now cut has so completely transformed the attitude of the engineer that in building the New York Aqueduct, which is practically a continuous tunnel nearly forty miles long, and the driving of which represented but three years' work, solid rock to cut in was everywhere sought for and desired in preference to earth or any soft or yielding material. Mr. Christie, chief engineer of the Pencoyd Iron Works, spoke of the extensive and highly satisfactory use of compressed air in that establishment, and of its economic value, notwithstanding that a large proportion of the air was lost by leakage or was wasted by the men. He mentioned specially the use of a jet of air to blow away the dust from an emery wheel working on steel, the blowing away of the dust and the comfort and health of the workmen being the only object intended and expected to be accomplished, but there was also a very appreciable increase in the work of the wheel. The jet of air kept the wheel cleaner and made it cut more freely and also kept the steel cooler. A number of pneumatic hammers, riveters, drills and other tools were exhibited, and the representatives of the makers spoke of the applications of them with which our readers are familiar. A good word was said for the rotary type of motors, because they are balanced and run without jar or rattle, although they are very wasteful of the air, one speaker saying that the piston motor could be run by the leakage of the rotary. Attention was called to the freezing up of the pneumatic tools and the choking up of pipes by the congelation of the moisture carried in the air. It was argued that more attention should be given to the piping of the receiver, it being claimed that the location of the pipes leading into and out of the receiver largely determined the amount of moisture collected there. Not enough prominence was given, probably, to the greater necessity of having the air as cold as possible in the receiver in order to precipitate the moisture. Mr. Walter Ferris described an ingenious attachment to a pump by which, without additional working parts, the air chamber may be always full of air compressed to the water-delivery pressure, thus greatly increasing the efficiency of the air chamber and relieving the pump of shock. This device is fully described in this issue. Mr. Dickerson, who had been associated with Mr. Tripler for a considerable time in his experiments with liquid air, spoke in high appreciation of Mr. Tripler's devotion to his work, but acknowledged that the statements in the current issue of "McClure's Magazine" were exaggerated, and not altogether warranted. Those who attended the meeting acquired added interest in the subject of compressed air and its present and prospective employment.

A Differential Grip Hoist.

The arrangement shown in the accompanying illustration is not a complete hoist in itself, but is designed for applying power to existing hand-operated hoists, or for hoists which may be operated alternatively by hand or power. It may be attached to the ceiling, as shown, or placed upon the floor of any story through which the vertical rope to be operated passes. It may be driven by a belt from running shafting, or may be belted direct to an electric motor. The two friction sheaves which clasp and drive the hoisting rope are normally held apart, so that the rope is entirely free and may be operated by hand, as though they were not in existence. The power is applied for hoisting by pulling down on the end of the horizontal lever, which operates to press the sheaves together and pull the rope at their own peripheral speed. The shafts which carry the sheaves are driven by interlocking spur gears, whose pitch diameters are the same as the diameters of the sheaves, so that both sheaves have the same surface speed, and the rope is driven by both gears, and not by the friction of one sheave upon the other. As here shown, the diameter of the smaller sheave (and gear) is one-half that of the larger, which enables the shaft which carries it to be run at a high speed. As the pulley is outside the frame it may be of as large diameter as may be required, so that there is no difficulty in driving by a direct belt from an electric motor. The gears are cut, and where extra quiet running is desired, the smaller gear is made of special fiber, backed in a flanged hole, as shown in the present cut. It is scarcely necessary to remark that in connection with this hoist, as for similar service elsewhere, the four-strand or "stevedore" rope is preferable to the three-strand rope in common use. The hoist is built by The Arthur Company, 188-190 Front street, New York City.



DIFFERENTIAL GRIP HOIST.

Random Notes from Germany on Things Mechanical and Otherwise—I.

BY HENRY HESS.

Last summer it became my pleasant duty to go, as one of a party of three, to Berlin, to aid in the planning of a new machine shop to be put up on American lines.

WAAREN AUTOMATEN.

Arrived in Bremerhafen, we ran up against our first "Waaren Automat"; that is German for penny-in-the-slot machine. I give this translation because you won't find it in the phrase-books that tell you all about how German "she might be spoke," if the other fellow would only say what the book says he ought to. And "Waaren Automaten" we ran up against in every possible and impossible place until we got back again on board ship, homeward bound. And they sold every kind of possible and impossible thing, from a glass of beer, *"helles* or *dunkles"* (you will find that in every phrase-book, at least in every one that has been edited by a German), to a Limburger sandwich, or toilet paper.

This particular Bremerhafen fellow gave you your choice of only dry goods; but for a nickel ten-pfennig piece, about two and a half cents—but no, let us remember we are in the land of German thoroughness and be as accurate as a United States Ordnance officer when he copies a French breech-plug thread and insists on having it made .9783 inch pitch and put just 2.398 cents into the slot—we could have our choice of six different kinds of chocolate or candies, a box of Swedish safety matches, a box of "vestas," guaranteed not to blow out by the fiercest German gale; a box of little wax matches, or a box of five-minute burner wax candles provided with real red-top heads that would take fire when vigorously rubbed against the seat of the grocer's pants, *a la* the time-honored story, and two cigars.

GERMAN RAILWAY TRAVEL.

The Lloyd runs a special train of its own from Bremerhafen to Bremen, and a very fine one it is, and with a good road bed. We had always heard that the European built roadbeds were away ahead of anything that we could show (except, maybe, the "Nickel Plate"), but that their cars did not come up to ours. Certainly this particular line deserved its reputation as to permanent way; the rolling stock was as comfortable as anything at home, and in decidedly better taste than what Kipling terms those "distressful palaces of all the luxuries," our parlor cars. But the trip from Bremen to Berlin! How the eagle would have screamed if only that glorious bird had not had all his attention taken up in hanging on with claws and beak. Now we found out why it is that the German sticks to his type of carriage with seats facing one another and no communication between compartments. They are so convenient when you find that you have to brace your feet against the edge of the opposite seat to keep from being jolted into your neighbor's lap. As for not having any through passage, I suppose that must be a precaution to save the engineer from being mobbed when the passengers get a more than usually severe shake-up. The cars are apparently hung on long-period springs that take up the long oscillations beautifully, but additional short-period springs to take up the sharp shocks are apparently considered as undue concessions to debilitating luxury. The roadbeds themselves are fair, but the rails are of light weight and of short length, with the joints in line, not staggered and between ties; the fish plates are short and on the sides of the rail—in many cases on one side only; the bridge joint is, at least, in such roads as I saw, quite unknown; the natural result is that every joint is noted and recorded for weeks on every bone in one's body.

As the genial chief of our party put it, travel is really very cheap here, notwithstanding the published statistics to the contrary. The statisticians are just benighted, unobservant fellows who fail to take into account that for every mile of forward travel there is also a second up and a third sidewise.

Passing into and out of the larger manufacturing towns we were everywhere puzzled to see quite large tracts of land cut up into very small enclosed bits, many of these with little huts on them, and were going to draw a very unfavorable comparison between the houses of the poor, down-trodden pauper labor of Europe and the lot of our magnificently taken-care of urban workers, when we found out that these were future building lots that were rented out in small tracts to workmen, who cultivated a little garden truck on them, while the supposed hovels were their tool and storage sheds. The holders of so-called unimproved real estate here and the workmen between them appear to have long ago realized the best features of Mayor Pingree's scheme.

BUILDING REGULATIONS AS APPLIED TO SHOPS.

On the ship going over, and before, there had been planned out quite a number of different arrangements of the various shop buildings, we fondly imagined that about all we should have to do would be to look the ground over, and possibly modify a little to suit the lay of the land. But *"Prosit mahlzeit"*—which my boy renders freely into idiomatic English as "Did you ever get left?"—man may propose, but it's the Berlin police that disposes. One of our first steps was to get an experienced local shop architect, and he just made mincemeat of our seven beautifully conceived, each-the-best-on-earth shop plans. And it was no use kicking; we had to give in, and since our heads were not like those of Martin Luther's compeers, no lead-bound volume, but only a little book of building police regulations was needed to bring us to terms.

The situation is quite outside of the city limits, on the banks of the Spree—which belies its name, and is a very mild, locked river, and never indulges in such ill-regulated affairs as sprees—at a place called Upper Beautiful Meadow, that gave the advantage of less rigorous regulations. They would permit us to put buildings on full 60 per cent. of our acreage, whereas if we had come under city laws, we would not have been allowed to cover more than 50 per cent. They would permit us to build our outside wall right on the line; but if we did not care to do that, back it must go 20 feet or nothing. Did we want to put up two buildings with a space between? Very good; but that space must not measure less in clear width than — per cent. of the hight of the higner adjoining building. After all, though we grumbled a good deal, when we did get through rearranging we found that we had been compelled into getting out still better designs than the "best on earth" first laid down.

As the Upper Beautiful Meadow does not boast of a sewerage system, the law compels putting down a complete settling and clarifying plant of such quality that the effluent must be perfectly clear and not in the least degree harmful to animal life, as the Spree teems with small fish that must be protected.

These stringent building regulations are really a very good thing for all concerned; they work no hardship on any manufacturer, since he and his competitors are all in the same boat; they are carefully framed to secure safety and good health. It is really very much of a question whether the expense that thus secures healthy and comfortable surroundings is not one of the best paying investments that the manufacturer makes. I rather suspect that, could the returns be shown up as clearly as those for outlays for labor and material, much more would be done in this direction than the law compels.

The law limits the hight of the buildings to a certain proportion of the street, which is responsible for one of the great charms of Berlin—the regularity of the sky line; the proportion is taken so low that each builder naturally takes the limit. While a regular sky line might easily produce a very monotonous appearance—as witness the hideous uniformity of the blocks on blocks of upper New York cross streets, where every house is so like its neighbor as to absolutely need the distinguishing number—that result is avoided by a very decided variety in the treatment of the facades; but that a broken sky-line alone, though it certainly avoids that *bete noir* of the artist, regularity, does not realize his striving after beauty and grace, is also proven in lower New York, where there are many fine buildings individually surpassing anything in Berlin; but one is not permitted to realize their beauty,

either through their being elbowed by dull, insignificant neighbors, or not allowed to come into effect by some hideously overgrown fireproofed dry-goods box. Practically all of Berlin, rich and poor alike, is housed in flats. Under the present law not a building may be put up in which there is even a single room or compartment that does not give directly with a full-fledged window on to a large open space; niggardly air-shafts do not count. The result is that the houses generally are built with a front and a rear house, separated by a court that must be 60 per cent. (from memory) of the house hight in width and length. Two side wings close off this court and join the front and rear house. The entrance is in the center. This arrangement secures light flats on each floor level, of about four rooms and a kitchen and bathroom each. This division refers to flats for fairly well-to-do people. Those who can pay more get correspondingly more rooms with less individual flats to a floor; those who can pay less get less rooms; while the landlord has more flats to rent out. Naturally, also, there is much diversity as to ornamentation, etc. A few houses even boast the luxury of a "riding chair," English "lift" and American "elevator." The German elevator, however, is really a luxury, for it certainly is not a convenience, nor yet, for houses never exceeding five stories, a necessity. As this institution has certainly come from us, the German very naturally looks to and copies our practice. He has heard some years ago that we get to the top in three minutes, and so concludes that he, too, will get to the top in three minutes; but his top is five stories and ours fifteen or twenty. Then a benevolent government that will not allow its sons to be maimed by anything short of the enemy's cannon steps in and says, "It is well known that the Americans are always in a frightful hurry and sacrifice all safety to attain speed. You must go three times slower than they." Then the elevator boy gets a vacation, except for an occasional stray foreigner on his first trip, and the native wonders what anyone wants with the things anyway.

The courtyards of these houses are very often beautified with shrubs and flowering plants, and through the wide entrances afford the passer-by delightful glimpses into their shady depths. The fire laws compel doors that will permit the passage of an engine and horses into each courtyard. Many houses have light projecting balconies that are utilized as hanging gardens by the nature-loving Berliner. In spring and summer time whole streets are brilliant with these hanging boxes of geraniums and other many-hued flowers.

PAVEMENTS AND SHOP FLOORS.

Good pavements are everywhere; Belgian block, asphalt and wood block chiefly. Owing to its noiselessness wood block pavement is being extensively put down; they were just relaying the principal street, the Friedrichstrasse, with it last summer. Contrary to our experience, they are, after long trial on many streets, very well satisfied with it. Possibly their success is due to the very thorough way in which the work is done. The foundation is in itself an excellent pavement of concrete and asphalt. The blocks are, I should say from memory, about 10 inches long by 3 inches wide and 8 inches high, set end grain up. They are laid herring-bone fashion—just why I could not find out, unless it be on the theory that the edges are not so liable to be chipped by the traffic. Every fifty feet or so the regular tar and gravel space of ⅜ inch is increased to an inch; the top is dressed with fine sand and gravel. That the surface filth does not penetrate it and create a nuisance I know from having inspected some old blocks in a section that was being repaired after eight years' wear on one of the busiest streets. The only odor noticeable was that of the tar-like substance with which the wood had been treated. This pavement is also in favor as a shop floor; one of the largest concerns in Berlin, or in the world, for that matter, uses it throughout. There the foundation is concrete, varying from 4 to 12 inches in thickness, according to the weight of the machinery to be carried. It is very much liked, as the end grain makes a very durable surface. Then, too, it is a very easy matter to replace a block that has been splintered by a corner of a heavy casting falling on it; much easier than to repair a section of planking. There is also none of the slivering that even a good maple floor shows after years of trucking and sliding castings over it. To the eye accustomed to our American shop floors it has at first, like all strange things, an unattractive appearance, but experience causes it to grow on one in accordance with the old saw that "Handsome is as handsome does."

A NOTABLE GERMAN SHOP.

This shop, one of those of the Allegemeine Elektricitäts Gesellschaft, familiarly dubbed for short the A. E. G., will very well repay investigation. The company has several other immense plants; in one they make electric lamps, switches, meters, etc.; in another electric cables of all sorts. The particular plant that most interested me was the machine shop for building dynamos and motors. In so far as the nature of the work does not prevent it they run three shifts of men of eight hours each. Their storage room alone is a sight, as they keep on hand a stock of 1,800 motors and dynamos of standard patterns. And they certainly do believe in taking their own medicine. Every machine tool from the biggest 16—24-foot boring mill, or a 144-inch Niles planer down to the smallest sensitive drill press is driven by its own individual motor. The shops are all arranged in aisles that are divided off only by the light lattice work crane columns, and it is indeed a strange sight to overlook all of the vast area full of tools and not a single overhead belt to break the view or bar access of the traveling crane to every machine. The bulk of the motors are five horse-power and under, and of the alternating, three-phase, induction type, with neither commutators, collecting rings nor brushes. They are started, stopped and reversed by a small switch, much like the round encased box switches used to control a group of incandescent lamps. Larger motors have collecting rings and brushes and are controlled through a liquid starting rheostat. For lathes and similar machines the favorite method of applying the power is to locate a motor on the floor just behind and close up to the head. A couple of brackets project from the rear wall of the bed and carry a shaft. This is driven by a belt connection from the motor. On these same brackets there is supported a swing frame that at the top carries a second shaft with a pulley for receiving motion from the first shaft, on which the frame pivots, and a cone for driving the head cone. In many cases the whole is so compactly arranged that there is only a bare clearance between the swing frame cone and the back-gear sleeve. Naturally my first question was as to the life of the short cone belt. Mr. Kayser, the very wide-awake shop manager, assured me that there was absolutely no trouble on that score, probably because the counter-weighted swing frame would never allow more than the proper tension to be put on. That argument also appealed to me as saving a good deal of wear and tear on the journals. The swing frame was controlled by a linked connection from the front of the headstock, so that depressing a lever would throw it forward enough to slack the belt and allow it to be readily and quickly shifted from one cone step to another. When a short stop was desirable, by thus releasing the belt tension the spindle could be quickly brought to rest by braking with the hand on the large cone step. This way had the advantage of speed, as only the momentum of the head parts had to be contended with, and it offered the further advantage of avoiding the loss of time otherwise attending the stopping and restarting of the motor and counter-cone. In some cases also the release was accomplished by a foot lever, or a rod running along the front side of the bed.

There has been of late a very noticeable tendency to provide more speed changes between the outside limits on lathes and similar tools. The A. E. G., too, thought that the usual head cone did not provide for sufficiently close gradations, and so used a cone to drive from the floor motor to the first driving shaft above described. The dimensions were so chosen as to give the correct intermediate speeds. But their experience has shown this to have been a quite unnecessary refinement. Only one of the steps shows the brightness of use; the others are dull, and would be rusty

if such a thing as rust were permitted. It is not that the men decline to avail themselves of any advantage to get out more work, as the piece plan is employed, and they are ready enough to use all real aids to a higher rate of production; they have simply found the extra speeds superfluous. Some years ago Mr. Kayser made a tour of inspection of American shops and brought back with him many notions that he proceeded to put to use. Throughout the plant there are evidences of the results of this trip in the shape of tools with American name-plates. Particularly in evidence are Niles and Brown & Sharpe tools. One advantage just comes to my mind of the individual motor drive. On a certain lot of machines a good many gears were to be used, which, for certain reasons of design, had to be partially fitted before being cut. The distance between the erecting space and the group of gear cutters was rather great, so to avoid the delay of transportation, they picked up a couple of gear cutters, carried them to the work and reconnecting the wires, were all ready to begin operations.

Studying the name-plates on some machines, I was struck by one bearing a legend to the effect that the maker (a German) guaranteed the tool against breakage for a certain time, I think six months. And a living up to the guarantee was enforced, too, by the holding back of a sufficient portion of the purchase price to cover contingencies. Granting that this really works as it is intended to, I wonder if it does not also tend to enhance the cost of the machine by the natural endeavor of the maker to ensure himself against men who never, no never! are careless, but always manage to find evidences of an old flaw—"See how the oil has worked in at that crack?"

REINECKER MACHINE TOOLS.

The tool-room was fitted with American and Reinecker machinery. While the latter bears the imprint of American practice, it is by no means a slavish imitation, but shows great originality and a greater variation in types than is often found between the product of different builders at home. Occasionally there is an absence of some of the handy features, but it is an open question whether this is not really an intelligent adaptation to local conditions. At any rate the foreman in charge much preferred them, and also claimed that his men did. They make their own calipers and gages and showed me a Reinecker measuring machine, which has a very ingenious and exceedingly delicate arrangement for measuring minute variations of length; the fixed anvil bears on the center of a diaphragm filled with liquid; from this rises a glass tube of very small bore, something like a thermometer. Normally the liquid stands at a certain level in this tube. An exceedingly small variation of pressure will cause a very large movement of the liquid in the tube either up or down, as the pressure is increased or decreased. I do not remember the exact dimensions, but if the diaphragm were, say, 3 inches diameter and the tube, say, .02 inch, the relative movement being inversely as their areas, would be as 1 to 22,500. In other words, with a slight change of the dimensions assumed, 1-100,000 inch variation of the specimen would show up in the tube by a variation of ¼ inch. The delicacy was shown in a way that at the same time strikingly illustrated the effects of small variations of temperature. The bed of the machine was massively constructed of cast iron, say about 3 by 4 inches, an inch test piece was held between the points. When the hand was held slightly above the bed there was immediate indication of its expansion by a considerable change in hight of the liquid column. Removing the hand and holding it above the test piece reversed the indication and showed up a much greater elongation of the test piece, as was but natural, considering its very much smaller mass. Certainly, if anyone had told me that just holding the hand for a few seconds over a 3x4 bar of cast iron would change its length a measurable amount, and provided he were not too big, I should have been tempted to use unparliamentary terms in expressing my doubts. If any reader is in the same frame of mind, I can only advise him in the language concluding the fairy tales of our childhood, to "go and see." The measuring machine is there yet, so is the test piece, and he carries his own hands with him. [A machine of the kind referred to was exhibited by its builder at Chicago, and is illustrated and described in our issue of July 27, 1893.—Ed.]

Having duly admired this example of the mechanic's art, the foreman thought he would take another rise out of us cocksure Americans, and showed us a little worm-wheel and pointer rigged up on a lathe carriage to indicate when to close the nut after having run the carriage back by hand, and expatiated much on the beauties of this arrangement in saving time over backing with the belt. Of course we agreed with him, but rather strained his esteem for us when we told him that we had often seen them in use at home, but when we assigned as a reason for not selling them with our lathes that they were not needed because every expert lathe hand could catch his thread all right without, we were almost hooted out of the shop.

Good machine hands over here are scarce as compared with fitters. Lathe men receive much the higher pay.

This shop had many more things of great interest to show, but space forbids to go into them now; but one that is particularly striking to Americans cannot be passed over. Naturally it is connected with beer. At nine o'clock and again at four it is customary to take a "snack," and this, of course, must be washed down with something. Now, we would use ice water and supply that free, but you don't catch the native applying his Kneipp cure internally. So the management has just taken the bull by the horns and instead of allowing the smuggling of beer, etc., they have established a canteen, from which at the proper time each man can secure what he likes in the shape of beer, weiss beer, mineral waters, or milk, and at a price just the nearest pfennig above the wholesale cost to the shop. In this way they can control the time and quantity, and also prevent the use of strong intoxicants. In most establishments the beer, etc., is carried in from outside by the boys and helpers. I have seen men loaded down with an immense quantity of bottles tied to a strap on the shoulder.

(To be concluded next week.)

Transfer of the Rhode Island Locomotive Works.

It was announced some time ago that the Rhode Island Locomotive Works, of Providence, R. I., had been sold to the International Air Power Company. The actual transfer of the property, however, was only accomplished on the 14th inst. As soon as the papers were signed, the representatives of the new owners went to the works and took formal possession, and although the works have not been in operation for a considerable time, steam was up, and a long blow of the big whistle was given. Upon the deed of conveyance were placed revenue stamps to the value of $3,025, this amount in stamps representing $3,025,000 in the transfer, although this is much in excess of the estimated value of the plant.

With the purchase of these works there has been a change in the name of the International Air Power Company, the word "Air" being dropped, and the field of the company's business thereby indefinitely extended. It is announced that the works are soon to be put in operation, and at first they are to engage in their regular work of locomotive building, beginning with an order for twenty-two locomotives for the Wabash road. The immense auto-truck business is to develop later. For the present it is announced that these interesting vehicles will be built at the American Wheelock Engine Works, Worcester, Mass.

Out of sixteen machinery catalogs sent to this office for notice during the past week, thirteen proved to be of one or the other of the standard sizes now generally advocated. This is very encouraging, and we hope the good work will continue.

"I understand Gotrox made his fortune out of a simple invention." "No. Out of a simple inventor."—"Indianapolis Journal."

Letters from Practical Men.

A Note About Steam Gages.

Editor American Machinist:

While looking over some back numbers of the "American Machinist" recently, I noticed a cut in connection with an article on the "Gearing of Traction Engines," issue of July 21, 1898. In this cut will be seen a safety valve, steam gage and whistle mounted on top of the boiler, and all branching out from one connection.

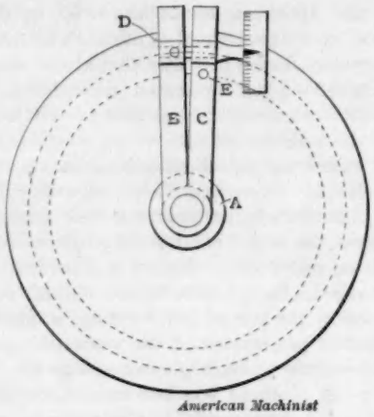
While this is a very neat, compact and, I presume, cheap way to attach the instruments, it is about the worst possible way in which the steam gage could be connected. This practice is followed by a number of traction engine manufacturers, and I should think that complaints from their customers about defective steam gages would be numerous. The objection to this way of connecting a steam gage is quite apparent when we stop to consider what occurs when either the safety valve or the whistle blows. The steam in rushing to escape passes the gage connection at high velocity, thereby causing an action similar to that of an aspirator, or the suction of an injector. This action draws nearly, if not quite, all of the water out of the gage siphon, and when the safety valve or whistle stops blowing, the gage will fill with live steam, heating it to a high temperature, which is liable to injure it permanently. The reading will then be inaccurate; but fortunately the gage will show more pressure than really exists in the boiler. A steam gage should always be attached to a boiler by its own separate connection.

J. G. KINGSBURY.

A Cheap Dividing Rig.

Editor American Machinist:

Enclosed is a rough sketch of a small job which recently came to hand. The foreman wanted a milling machine dial with a different number of holes from any in the shop, in this case forty-nine. Having one of fifty holes, this cheap rig was made in a very short time, and it did the work with sufficient accuracy, although not theoretically correct, and was made as follows: The plug *A* was turned to fit the large hole in the dial, with a smaller turned projection to act as a pivot for the jointed arms *B* and *C*. The swivel block *D* was located so that its turned end extended through *B* and entered one of the fifty circle holes of the dial, acting as a gage pin. This block *D* also held the end of the micrometer screw of 25 threads per inch, with 40 divisions upon its head. A similar block upon *C* (without the extension), threaded for the screw, gave the necessary adjustments. The jig hole *E* was drilled in arm *C*, at the desired radius for the new circle of holes. In action it was simply necessary to calculate the difference in distance between two holes of a row of fifty and of forty-nine upon the same circle, and move arm *C* from *B* that amount by screwing in the micrometer screw at each drilling, the projection of *D* being also transferred to the next hole. This worked so very well that I asked the



CHEAP DIVIDING RIG.

foreman's permission to send it to you, thinking it might possibly be of use to someone.

H.

Marking Size on Drills.

Editor American Machinist:

To retain the size marks on twist drills seems to be a vexatious question. Marking on the end for large sizes works well and is a good makeshift for a drill-user. I have used it for several years. But there may be one solution of this difficulty that I do not recall seeing mentioned, which is, to stamp the size on the land at the beginning of the grooves, and as the drill is hardened at this point, it won't wear off—in fact, it seldom or never goes into the chuck so far.

I can see no serious difficulty in doing this thing, for we have drills with a lengthy inscription about "Schofield's patent grinding line," with dates, etc., stamped in just this place, and room on the opposite land for the size mark; but instead that was worn off long ago, consequently our use of marks on the end.

CHARLES S. BEACH.

Bennington, Vt.

Tool for Making Ball Joints.

Editor American Machinist:

With the tools usually found in the toolroom it is no easy matter to turn a ball on the end of a rod when it is required that the ball shall be nearly round and of a given size. There are many devices for doing the work, but the tools here shown have the advantage of being easily made and accurate and rapid in their operation. They will make but one sized joint, but can be depended on to do that until worn out without varying .0001 inch.

Take any conveniently shaped piece of steel *A*, about 1-16 inch thick; drill and ream the hole *B* to the size of the ball required; countersink the under side of the hole *B* with a 60-degree center countersink to within 1-64 inch of the top. Cut out the neck *n* to the shape required; narden the tool, and it is finished—unless great accuracy is required, when the hole must be lapped to size.

It is better to rough the ball out before using the tool; but the whole ball can be turned without that, by using plenty of lard oil. The drawing shows the method of using the tool, which is to crowd it over the work *D*. This is held by the lathe chuck *C*. Use the lathe tool *R* as a rest, *R* being held in the position by the post *I*.

To make an accurate boring tool for the socket, file one of the balls already turned to the shape shown in Fig. 2. This tool will bore a true socket. The socket

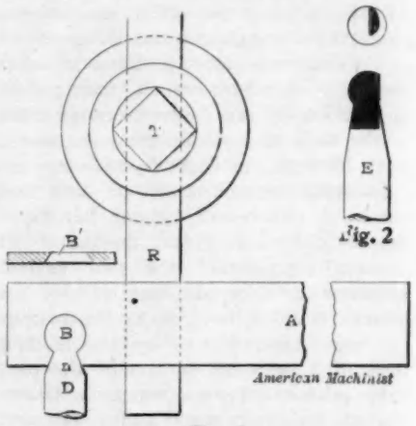


Fig. 2

Fig. 1

TOOLS FOR MAKING BALL JOINTS.

can be made up of two pieces joined in the usual way, or of one piece, which must be sawed open to allow the ball to enter.

C. H. WILCOX.

Springfield, Mass.

Turning Shear on Dies.

Editor American Machinist:

In blanking circular and other forms of sheet metal, when the thickness or circumference becomes too great for easy cutting, it is always best to make the punch or die with a shear equal to at least the thickness of the metal to be blanked; whether the die or the punch is to have the shear is of course determined by the character of the piece required.

The usual method employed here has been to lay out the shear on the die or punch and then to cut the shear on either the planer, shaper or milling machine, as most convenient, there not being much choice as regards doing a satisfactory or expeditious job.

Fig. 1 shows a circular blanking die 8 inches in diameter with 3-16 inch shear equally divided between three points of the circumference. Recently a similar die broke when it should not have done so, and, as usual in such cases, the new one to replace it was wanted at once, or sooner.

The die was nearly finished in the lathe, and while scheming how best to lay out the shear by means of the gears and lead-screw, the possibility of turning the shear

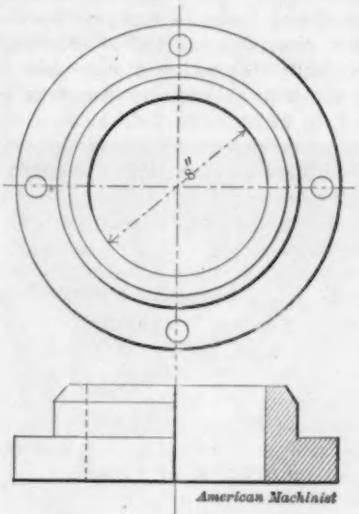


Fig. 1

DIE TO BE "SHEARED."

in the lathe by the same means suggested itself, and soon became a reality.

The scheme is so simple (as a glance at Fig. 2 will show) that it has probably been used before; but as it is new here, a short description may be of interest. Fig. 2 shows an arrangement of crank, pitman and gears on the headstock of the lathe, the lateral motion being imparted to the carriage and tool by means of the lead-screw, which was given an oscillatory motion by means of the gears *D* and *C* and the pitman and crank shown in the sketch. The lathe used was a 26-inch swing Blaisdell with ½-inch pitch to the screw, the gears being 8 pitch. The cross-feed was used as usual with the belt feed (not shown), the depth of cut being regulated by the compound rest.

The ratio of gears *A* and *B* is of course 3 to 1; one turn of the spindle giving the crank three turns, and, consequently, three cycles of lateral movement to the carriage. This lathe has a compound pair of gears on one sleeve, of 24 and 48 teeth. We used the 24-tooth gear for *B*, a 72 for A, and drilled and tapped gear *e*, which was outside of *B* on the stud, at a radius of 1¾ inches, for the crank pin *H*, Fig. 3, which shows the entire attachment. The crank pin was made from 1-inch stock; one end turned to ⅝ inch diameter, 1 inch long; the other end threaded ⅝ inch to fit the gear. The pitman is a piece of ⅝x1¼-inch machine steel, with two ⅝-inch holes at the same distance as the centers of *B* and *C*. The connection to *C* is by means of the two straps, one of which, *i*, is tapped ⅝ inch, the other, *j*, being drilled for ⅝ inch cap screw *k*, the two being clamped to the arms of gear *C* by means of the nut *l*.

As the pitch of the lead screw is ½ inch and the desired shear was 3-16 inch, it is obvious, neglecting slack, that it would not be practical to connect directly to the lead screw gear, as this would necessitate a too near approach to the dead centers; hence the intermediate gear *C* was employed. Subsequently we have for a less amount of shear connected directly to *D*, using, of course, a longer pitman.

A simple improvement, especially for a

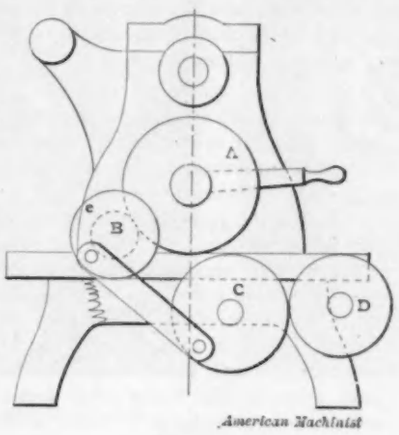


Fig. 2

GEARING FOR SHEARING CUT.

lathe with a finer pitch lead screw, would be to use a bell crank instead of the lead screw, slotting one of the arms to secure different amounts of shear, the bell crank to be secured to the lathe by a suitable bracket, using universal couplings to connect to the crank, and connect the short

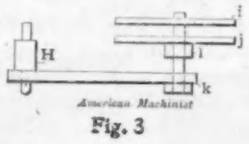


Fig. 3

arm of bell crank directly to the carriage. The rig, as shown, required two hours to make and attach, and saved several times its cost on the first die made. It has since been used a great many times, and is doing good service; so it is hardly likely to be replaced for some time.

G. J. M.

Milwaukee, Wis.

The Pencoyd Iron Works shipped to Africa, a couple of weeks ago, and five weeks after receiving the order, seven spans of a bridge to be erected for the British Government across the Altora river, near Khartoum, in the Soudan. A gang of men from the works are to follow and set it up. The bridge as constructed will be 1,100 feet in length. The British War Office wanted the bridge completed before the fall campaign, but could find no British builders who would promise to deliver it in less than a year. The contract time of the Pencoyd Works was seven weeks.

International Trade Opportunities.

SWEDEN.

The imports of machinery, implements and tools into Sweden are steadily and considerably increasing year by year, having amounted to the following values: 7,134,109 kroners in 1893, 10,962,399 kroners in 1894, 11,150,263 kroners in 1895, 13,421,000 kroners in 1896. The great bulk of this is supplied by Germany and Great Britain, while the share of the United States is very unimportant. The best idea about the insignificance of our machinery trade with Sweden can be formed by comparing the following figures, which, however, represent our exports to the dual kingdom, Sweden and Norway, with the above given Swedish imports.

The United States exported to Sweden and Norway:

	Miscellaneous Machinery	Saws and Tools
1893	$35,798	$1,575
1894	41,953	3,053
1895	58,808	7,732
1896	98,373	15,081
1897	276,686	16,248

It will be noticed that there has been a considerable increase in our exports in 1897, but much more could be done, especially in machine tools, if more energetic steps were taken.

Sweden's machinery industry is well under way, and the demand for improved machine tools is increasing. In 1893 the exports of Swedish-made machinery amounted to the value of 3,511,662 kroners, and rose to 6,406,000 kroners in 1896. Machine tools for the metal-working industries naturally play an important part in an iron-producing country like Sweden, and the large demand for such goods cannot be met by the native manufacturers. The industry is dependent to a large extent upon importation from abroad. The chief place for the manufacture of machine tools in Sweden is the town of Eskilstuna, where in about a hundred workshops, with, in all, some 3,200 workmen, work is turned out to the value of about $1,000,000 annually. The principal Swedish machine-tool maker is the Köping Engineering Works, of Eskilstuna.

JAVA.

It is perhaps but little known among American manufacturers that there are quite a number of important engineering works in the Dutch East Indies. By far the most important industrial city of Java is Soerabaya, and most of the engineering works are, at the same time, the leading importers of machinery and tools. A brief account of the principal establishments will no doubt prove of interest. All the following works are situated in the city of Soerabaya:

De Nederlandsch Indische Industrie Maatschappij.—A stock company with a capital of 1,000,000 florins. The company, whose general manager is Mr. C. N. Noppen van Paddenburg, has machine

shops, dockyards, foundries, large blacksmith shops, etc., and imports all kinds of machinery, tools, iron and steel. They are also interested in the importation of sugar and coffee machinery. The headquarters of the company are at Rotterdam, in Holland.

N. V. Soerabayasche Machinenhandel, formerly Becker & Co., also a stock company, with a full paid capital of 600,000 florins. The manager is Mr. J. R. Becker, and the headquarters of the company are at Amsterdam, Holland. The firm possesses machine shops, foundries, repair shops, etc. They import all kinds of industrial and agricultural machinery, railway material, tools, etc., etc. Sugar machinery is a specialty of the company.

N. V. Oost Javasche Machine and Werktnighandel. A stock company with a capital of 150,000 florins. Mr. J. H. Straub is the chief of the engineering department.

Javasche Electricitcit Maatschappij, formerly Hekking & Co. Importers of all kinds of electrical machinery and appliances.

Machinerie Handel Maatschappij, formerly I. A. Ceulen & Co., with headquarters at The Hague, Holland. The general manager at Soerabaya is Mr. H. C. Pennink. This firm is especially interested in the importation of sugar and coffee machinery, implements and tools, and industrial machinery.

Maatschappij Vander Linde & Tewes, a stock company working machine shops, foundries, boiler shops, etc., and importers of all kinds of machinery and tools.

The importance of this market may be gathered from the fact that the importation of machinery and tools amounted to a value of $2,073,200 in 1896, of which $581,200 worth was sugar machinery. The great bulk of all this machinery is either British or German, Great Britain, however, getting the lion's share of this trade. The magnitude of the Javanese sugar industry is illustrated by the fact that in 1897 187 factories were in operation, with a total output of 585,870 tons of sugar.

The United States' share in this trade amounts to almost nothing. In 1897, for instance, our total exports of machinery to the Dutch East Indies were valued at $51,402. This market should by all means be cultivated to the largest extent possible, and nothing should be neglected by our manufacturers to secure a better footing in Java. Special attention should be paid to sugar, coffee, rice, petroleum and gold mining machinery.

GUATEMALA.

The staple industry of the country is coffee planting, but now several of the agriculturists are planting sugar cane, and consequently there is a good opening for machinery. Indian corn, or maize, as it is called, is the principal article of food in place of bread throughout the republic. To prepare for use it is manipulated by first being allowed to soak and then is ground with a stone roller upon a stone slab, kneaded by the same process, and then made into tortillas, which process is carried on daily, and with some families twice a day. In case some of our manufacturers should manage to make a cheap machine, something after a coffee mill, the price being such to be within the reach of the masses, there would be an endless sale for it, not only in Guatemala, but throughout the whole of Central America. The people have taken kindly to sewing machines, and have them even in Indian huts, where in most instances it is the only article of value they possess.

TUNIS.

American manufacturers might with advantage endeavor to cultivate the trade in metal goods in Tunis. American machinery is quite unknown there, and this notwithstanding the great increase in the demand which the extension of the principal industries has created. Oil mills and presses are being erected in numbers, and require extensive plants and those of a nature such as is manufactured in the United States and extensively exported. Tunis, however, like many other foreign markets, does not appear to come within the sphere of American operations, although there is possibly more likelihood of the oil industry assuming greater dimensions in Tunisia than anywhere else.

ROUMANIA.

The kingdom of Roumania is in every respect one of the most progressive of the Balkan States. Industries are being developed more and more, and the demand for all kinds of industrial and agricultural machinery is increasing. In 1896 the imports of iron, steel and machinery amounted to the very considerable value of $12,170,000, of which Germany supplied $4,600,000 worth, Austro-Hungary $3,200,000, Great Britain $2,100,000, while the imports of iron, steel and machinery from the United States amounted to $19,000. American petroleum (oil-well) machinery and agricultural machinery would find a ready sale in Roumania if properly introduced. G.

A Large Pattern Lathe.

BY JOHN RANDOL.

The isolated shops usually are the ones which originate peculiar methods, and these peculiar methods are often highly valuable. An instance of this is to be found in the heavy pattern lathe at the iron works of Struthers, Wells & Co., Warren, Pa., from which Figs. 1, 2, 3 and 4 were taken. This pattern lathe originally consisted of the lathe only, shown at the left and rear of Fig. 1. It has a head of ordinary construction with a spindle abutment-bracket arranged to be changed to either the front or the back of the headstock, the thrust bearing being taken by a flat-ended hardened center, which slips into either one of the similar center-seats in the front and rear spindle noses. The lathe head can thus be used for either ordinary turning between centers or for large face-plate work over the end of the bed.

The bed of this lathe is fitted with a saddle driven by a rack, pinion and hand crank, and having a tool-post traversing on a cross-slide on top of the saddle. Originally this tool-post slide was fitted on top with an ordinary American tool-post, in which tools could be secured for use on work either between the centers or on the small face-plate at the front end of the head-stock. It occurred to Robert H. Lynn, the head pattern maker, that something in the nature of an adjustable cross-slide or frame to take this saddle, which is readily removed from the lathe shears at the rear end of the lathe, would be a great aid in large face-plate pattern work, and correspondence was opened with the makers of the lathe in regard to something of this description. The makers said that they had never seen nor heard of anything of the kind, and that the idea did not strike them as feasible, and they would prefer not to make anything in that line without specific directions. Lynn accordingly produced drawings for a 6-foot bed, having similar shears and rack to those of the pattern lathe itself, and therefore adapted to take the saddle belonging to it. This bed is mounted on a pair of lathe legs, all as shown in Fig. 1, which brings the top of the shears of this supplemental frame level with the top of the lathe shears. The feet of this supplemental frame are not fastened to the floor in any way, consequently it is free to be moved into any position called for by the work. Marks on the floor show when the supplementary frame stands at right angles to the lathe spindle, in which position work would of course be faced flat by the traverse of the lathe carriage, a proper tool being fixed in the tool-post. Then Lynn completed his invention by the production of a new cross-slide fitted with a round sliding tool bar, hand actuated, carried in a round sleeve fixed at any desired point by a set screw, and mounted on a circular foot on top of the tool-slide, so as to be capable of making an entire revolution; a clamping screw, shown in Fig. 3, being introduced, by means of which the sleeve can be held stationary. All of this arrangement is very clearly shown in Fig. 2. The diameter of this round tool-slide is 1¼ inches, and its length 24 inches. One end of it has a straight ⅝-inch hole drilled into it for a sufficient distance, and it is provided with a set screw at the side. The tools are forged to suitable shape on ⅝-inch round tool-steel shanks. They are simply slipped into place in the tool-slide, and secured with a set screw. The round tool-slide is splined, and provided with a stud in the usual manner to keep it from rotating, and it may be operated directly by hand in the sleeve, independently of the cross-slide, and screwed on the saddle,

or the sliding tool-bar may be fastened in the sleeve by means of the set screw shown in Fig. 2, and then the cross-slide screw or the saddle rack and pinion may be used to move the tool in the desired direction.

For all angle work the tool-slide sleeve can be set to the proper position, and for all hollow work required to be turned to uniform radius the tool-slide can be fastened in the sleeve so that the point of the tool will be the proper distance from the center of rotation of the sleeve, and the sleeve can then be turned on its circular base so as to give a perfectly accurate surface at the first trial, instead of obtaining it by a great number of trials and the patient use of the rubbing templet and blue chalk.

This circular rest sliding tool-bar, mounted on the cross-slide post of the saddle, forms a unique combination entirely unlike anything within the previous knowledge of the writer, and possessed of far more advantages in use than appear at first sight. By setting the tool-slide sleeve, any desired draft angle may be secured and maintained throughout a cut of any depth, no matter how small the diameter of the cut produced; and, having the angle of the draft thus fixed, it is only necessary to make the outside measurements correct, the terminal diameter of the cut taking care of itself. All of this requires vastly less skill on the part of the workman than where the tools are held and guided solely by the hands. For small work, up to about 20 inches radius, this 24-inch sliding bar is sufficient. Figs. 3 and 4 show the arrangement for producing an interior cut of larger radius. In this case the 1¼-inch tool-slide is 8 feet long, and is used in connection with the ordinary tripod rest, as clearly shown in Fig. 4, the supplementary bed being set around to marks on the floor, which bring it in line with the lathe bed. This enables the workmen to produce a hollow curve up to nearly 16 feet diameter with absolute certainty.

Fig. 4 shows the position of the workman when turning an interior curve surface of comparatively large radius, and a diameter much greater than could be swung on the front end of the lathe spindle. For use in front, the 24-inch tool-slide is long enough for all ordinary operations; it only takes a minute or two to slide the saddle off from the supplementary bed and place it on the lathe bed, the saddle fitting one as well as the other, and being, of course, gibbed to slide the same on either. For work on the front end of the lathe spindle the sliding tool-post is used almost to the entire exclusion of the ordinary hand rest.

The experienced wood-turner will at once see the very great advantages of this arrangement. At least half of the time ordinarily consumed in the production of a piece of work by hand tools can be saved by the use of this compound rest, and it is, of course, a very great advantage to have all drafts of uniform angle, and to avoid the possibility of a tool "catching," as sometimes happens even with the most expert hand-turners. All the forms usually required in pattern work can be produced by the aid of this slide with great certainty and expedition, and without the exercise of that marvelous skill which makes the work of an expert wood-turner such a fascinating spectacle. The whole arrangement costs but little, and is unquestionably a very great addition to the resources of any pattern shop.

The circular base of the tool-slide sleeve was made without drawings, and I therefore give a sketch, Fig. 5, of a suitable joint for the place. The outer retaining

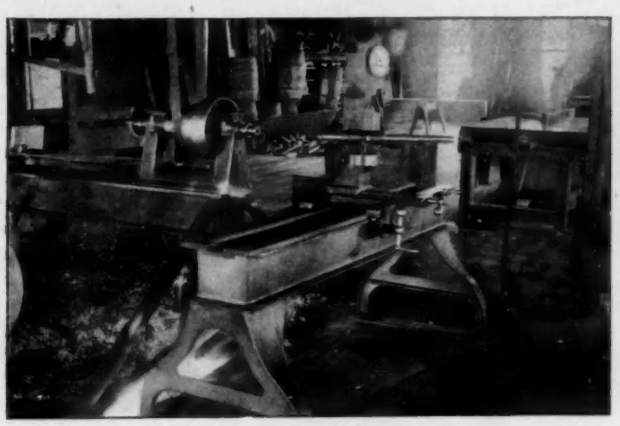


FIG. 1. THE PATTERN LATHE AND SUPPLEMENTARY BED FOR TOOL-SLIDE.

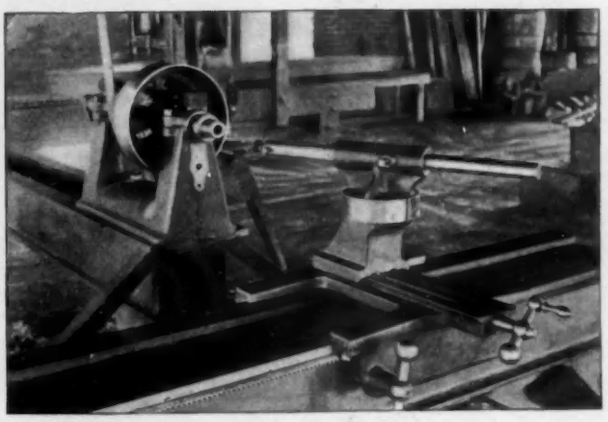


FIG. 2. PATTERN LATHE SADDLE AND SWIVEL-BASE TOOL-BAR SLEEVE.

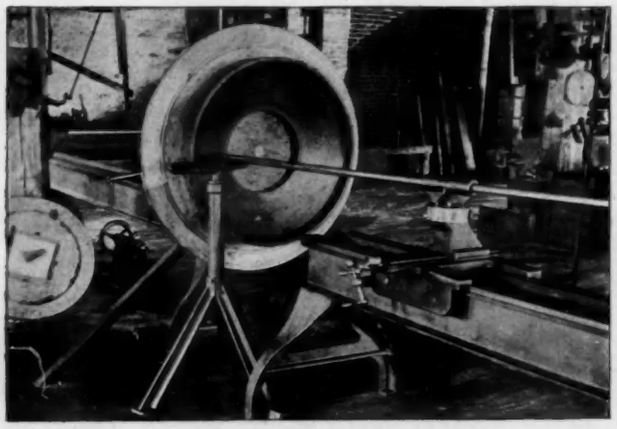


FIG. 3. LYNN'S PATTERN LATHE AND LONG TOOL-BAR.

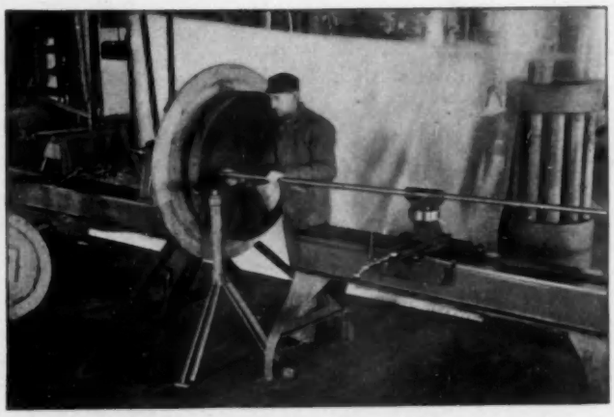


FIG. 4. LYNN'S PATTERN LATHE, WITH LONG TOOL-BAR IN USE.

ring is of necessity cut into two pieces after being finished, as the joint could not otherwise be assembled. In this sketch pinching screws are used, instead of the set screws shown in the photographic reproductions, for binding the round tool-slide, and the revolving base of the sleeve which supports the tool-slide or bar. This sleeve base is made with a round shank *S*, which is a turning fit in the seat bored in the cross-slide of the saddle, and the lower

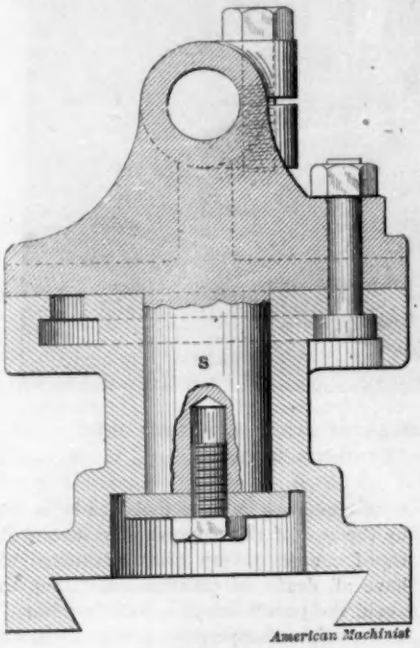


Fig. 5

REVOLVING TOOL-POST FOR PATTERN LATHE.

end of *S* is fitted with a washer and screw, as shown, so as to turn freely without shake or lift. It is generally better to bind with pinching screws, which clamp the parts together, than with set screws, which tend to force the parts asunder.

Selling American Machinery Abroad

Editor American Machinist:

I have just been reading your journal of February 23, in which you give a long extract from the report from the American consul in Birmingham, who has been investigating the American machinery business in that district. Of course the publication of this extract in your journal gives it a very wide prominence, as it reaches the engineers of the whole world, and such an article is bound to carry considerable weight with it from its being the report of the American consul. So far as that information is correct I thoroughly approve of it, and am very glad to have the information given out in such a form.

His reference to American manufacturers granting exclusive agencies to anyone who may desire to take up such an agency either in Great Britain or on the continent, is quite to the point. Many of our American manufacturers have been unwise enough to tie themselves up to firms on this side who have no special connection with the engineering trade, and who have relied upon getting a business here simply because they were offering American goods. In some instances the parties asking for such agencies are simply merchants, having ordinary travelers with no mechanical knowledge of either the construction or uses of the machinery or tools they are wishing to sell, or any acquaintance with the engineering trade who are to be the customers. The attempt to introduce high-class goods by such parties cannot be very satisfactory to the manufacturers, and in all probability there are a number who will withdraw from their contracts at the expiration of the time to which they have bound themselves.

His statement is also correct in regard to parties taking up American machine tools in this country when their greater interests lie in the introduction of goods they are manufacturing themselves in rivalry. There is no question but what considerable business of this kind has been done, and the American goods put in only when the parties could not supply their own.

The consul also touches upon another important point, and that is of American manufacturers receiving orders direct from parties abroad who have obtained their information in regard to the goods from recognized agents, and then have gone behind their backs and bought the machines or tools direct from the makers. Such transactions are exceptional, although they do occasionally take place; but any manufacturer who has a genuine agent should at no time receive orders direct without allowing the agent the commission which he has properly earned. On these points I cordially agree with the consul's report; but he then gives some statistics which are so greatly at variance with the actual facts that I protest against such information being published in your journal as authentic.

He says that "one great American concern has sold over 4,000 costly automatic machines in that neighborhood alone, and has the best little machine shop in that city, where it can set up and display the machines, but it still pays some commission to the big machinery house it originally dealt with." This would indicate that the big machinery house was unsuccessful and the manufacturers came and established a business, and did this large amount of trade.

In the first place the quantity he gives exceeds the total output of the concern since they began business, and to get at the proper number that have been sold in this country it is necessary to take off one figure and reduce it to about 400, for this is nearer the number sold by the agents before the branch office was established. If facts were stated as to subsequent sales they would be at equal variance with your Consul's report. He also totally ignores the fact that the machinery house in question has in connection with it a very complete machine shop, entirely fitted up with American machinery and worked by engineers with American education, manufacturing tools for automatic and other machines, and this shop has successfully developed on these "costly automatics," operations unsuccessfully attempted by the branch extolled in his article.

It is evident to the writer that the investigations of the American Consul have not been so complete as his report would indicate, and the article reads as if inspired by the representative of the manufacturers, who are using this channel to exploit their own manufactures. Having this in view I desire to guard against any statement of facts degenerating into a counter puff. The conditions that are given in regard to the working of material, tools, etc., in the article are only what have been met with here for years; the situation is changing continually and English manufacturers are realizing that in order to use up-to-date machinery they must have proper material to work with. American manufacturers are finding good markets here for such material, but English manufacturers are also now producing it in a suitable condition for automatics.

The introduction of American machinery has not been simply a matter of two or three years, as the article would indicate. It has been a steadily growing demand for many years past. It was boomed a little through the bicycle craze, but the present time shows every evidence that trade in American tools throughout Great Britain will steadily increase in the future.

It behooves every manufacturer to know that whoever is representing him as an agent should be not simply a good business man, but one who is practical and thoroughly understands the engineering trade, both as to the construction of tools and the setting up and working of them, as this is one of the important factors of the present day.

The question as to whether it will pay a manufacturer with a limited line of tools to establish such an agency as referred to, had better be answered by those who have tried it. Criticism might be considered biased from those who, though not hampered by such a narrow field, yet know exactly the expenses and difficulties that stand in the way.

The occasional visit of manufacturers to England to call upon customers in company with their agents, is a valuable assistance to the agent, and one that is always commended, as it gives the manufacturer an opportunity to see the work that is being done by his representative, and also often indicates to him the needs of the user on this side, so that he can better meet the circumstances that prevail.

CHARLES CHURCHILL.

London, England.

[American consuls are not allowed to

take part in newspaper controversies, and for that reason, if for no other, Mr. Halstead cannot reply to the letter of Mr. Churchill, and it becomes proper, therefore, for us to say that we happen to know that Mr. Halstead wrote 400 machines, not 4,000, and that the error of adding the cipher occurred in the Government printing office. We have heard and know a good deal of the work done by Mr. Halstead in the interest of American machinery builders and their business in Great Britain. Very many Americans have met him there, and they all speak in very high terms of his devotion and of the quality of his work as consul. We cannot believe that he has in any way been influenced by wrong motives in preparing his report, or that he intended to publish matter designed to "puff" any certain firm or its products at the expense of others. As no manufacturer's name was mentioned in Mr. Halstead's report, we do not see how it could have such an effect. Perhaps his ignoring of Mr. Churchill's shop was because he did not happen to know of its existence. That is at least easily possible, and perhaps when Mr. Halstead has had as much experience at writing for publication as the present writer has had, he will be very guarded in his statement about "the best shop," etc. Such statements are almost sure to be sincerely challenged, and often proven to be incorrect. It is better to say that the shop is a good or an excellent one, and let it go at th t.—Ed.]

Technical Publications.

We are in receipt of a pamphlet containing reprint of a paper recently read before the Birmingham (England) Association of Mechanical Engineers by Mr. Archie S. B. Little. The paper deals with the subject of labor economies brought about by machinery, especially that class of machinery used in the conveying and handling of materials in regular quantities, such as coal, coke, iron ore, etc. The author cites several instances where the use of such machinery has materially reduced the cost of such operations.

"Proceedings of the Society for the Promotion of Engineering Education." Vol. VI.

As we have before remarked in these columns, there is no influence extant, looking toward the advancement of engineering education, which is equal to that of this society, and there is no means whereby practicing engineers could if they would produce so much effect on engineering colleges as by joining it and attending its meetings. The society has now 244 members, and appears to be in a flourishing condition. At any rate the papers read before it are usually on live educational topics, and the discussions on them are full and pointed.

"How to Make an Indicator." By A. C. Lippincott. Published by the New York Publishing & Model Company, 1 Cortlandt street, New York. Paper, 50 cents; cloth, 75 cents.

This is a small pamphlet giving detailed directions intended to enable a working engineer to make his own indicator. The author has had a good deal of experience in the manufacture of the instrument, and the book is thoroughly practical. It does not go into the theory of the instrument at all, but simply tells in plain language and by simple illustrations how anyone possessing a few tools and some mechanical ingenuity or training can make a working indicator at a cost for materials of $2.50.

"Machine Design. Part II. Form, Strength and Proportions of Parts." By Forrest R. Jones. 353 6x9-inch pages, with 179 illustrations. Wiley & Sons. Price, $3.

Part I of this work was noticed in these columns under date of January 13, 1898. The present volume treats of those branches of the subject named in the title. The work is intended for students in engineering schools, and is quite mathematical in many sections. It, however, contains a large amount of matter of a different nature, and bears every evidence that it was not written in a library. It collects a large amount of material from recent investigations, and presents an unusual number of designs of machine details and tables of proportions which have been furnished by various leading machine shops. It is, in fact, well worth having for these portions alone, even by those who are unable to follow the analytical discussions.

"The Commercial Management of Engineering Works." By F. G. Burton. 310 5½x8½-inch pages, with numerous illustrations of blanks and forms of accounts. The Scientific Publishing Company, Manchester, England. Price, 12s. 6d.

This work is a complete exposition of the organization and system of management of manufacturing enterprises, and is by a gentleman of experience as secretary and general manager of a shipbuilding works. It is well known that accounting in a large sense has received much more attention in England than here, and that the methods followed there are in general more thorough than with us. The methods explained in this book will appear to the average A erican manager as unduly elaborate, but in the present state of active interest in the subject with us, this explanation of English methods should prove of decided interest. One feature of the book is its recognition of accounting in an industrial works as properly the work of an engineer rather than a bookkeeper. We have long regarded the bookkeeper of such a works, when properly organized, as little more than a clerk carrying out the engineer's plans. It is simply impossible for a bookkeeper to possess the kind of knowledge necessary for the intelligent direction of this work, and whatever may be the situation in a purely mercantile business, in which the transactions are limited to buying and selling, it is as certain as anything can be that when manufacturing is added to buying and selling, the bookkeeper has long occupied a pedestal on which he does not belong.

"Boilers and Furnaces Considered in Their Relation to Steam Engineering." By Wm. M. Barr. 398 6x9¼-inch pages, with 468 illustrations. J. B. Lippincott Company. Price $3.

This is an excellent book—one of the kind in which an engineer is not disappointed. It relates strictly to its subject, is strictly up to date, and is full of information of the kind wanted. Perhaps the most notable feature of it is the chapter on riveted joints, which is composed chiefly of the results of tests made for the navy on the testing machine at the Watertown Arsenal. These tests extended over a period of more than ten years, and while published from time to time as made, they have not before, we believe, been brought together, digested and analyzed. This Mr. Barr has done, and the result is probably the best collection of data on this subject extant. The data given cover all forms of joints in common use, and are given in extended and well-arranged tables, while a great number of engravings show the joints tested with the method of fracture indicated. The book is illustrated throughout with a wealth of illustrations showing a great number of arrangements and constructive details, all having been made from drawings executed expressly for this book—no stock illustrations whatever being used. The mechanical execution in engraving, printing and binding is excellent, and the book can be unreservedly commended.

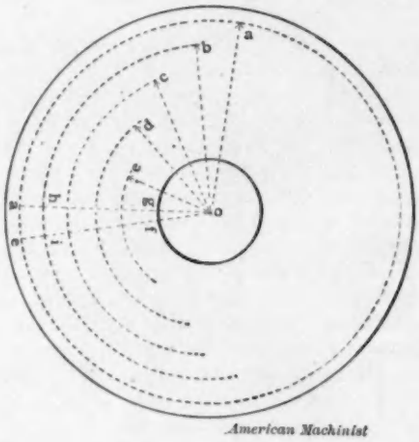
Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer by mail.

(33) N. P. D. asks: Is it good practice to grind a bearing to a fit with flour of emery and oil? The box is 5 inches long, 1 3-16 inches diameter, and two of them support a cylinder which is about 6 feet long and weighs about 150 pounds. It makes 1,200 revolutions, and must run perfectly true. A.—Whether fitting by this method is good practice or not depends upon some conditions which you have not mentioned. If the shaft and box are both of hardened steel, then the method mentioned is a good one; but if the boxes are of cast iron or of any soft alloy, then the method is not a good one, because such a

box treated in that way becomes a lap which continues to grind during the operation of the machine. Then where any considerable grinding is done by this lapping operation, and the work is to run perfectly true, the grinding of the work must be done while supported and run in the bearings themselves.

(34) E. C. R., Lansing, Mich., sends a sketch which is reproduced in the figure, and which represents a hollow drum. This drum is supposed to revolve about its axis *o*, and to be filled with water, and our inquirer desires a formula for finding the pressure at different radii due to the centrifugal force of the contained water.



A.—Use the ordinary formula

$$F = .000341\ W\ R\ r^2,$$

in which

F = centrifugal force in pounds,
W = weight of body in pounds,
R = radius in feet,
r = revolutions per minute.

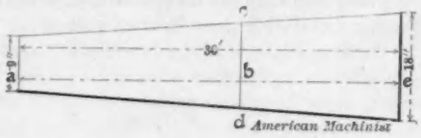
To use this formula for radius *a*, take for W the weight of the truncated wedge of water *d e f g*, and for r the radius of the center of gravity of this wedge. To find the pressure at radius *b* use the weight and radius of center of gravity of the truncated wedge *h i f g* inside of *b*, and so for any other radius. Note that the resulting pressure is not in pounds per square inch, but is the entire pressure on the base of the truncated wedge—these bases growing smaller as the wedges grow shorter. To find the radial position of the center of gravity of the truncated wedges —or trapezoids, as they appear in plan—use the formula

$$x = \frac{b_1 - b_2}{b_1 + b_2} \times \frac{h}{6}$$

in which

x = distance of center of gravity from longer base,
b_1 = length of longer base of trapezoid,
b_2 = length of shorter base of trapezoid,
h = hight of trapezoid.

(35) H. A. A., Port Richmond, Staten Island, N. Y., asks: Supposing the figure in the sketch to be divided into two portions of equal area by the line *c d*, how can I, by algebra, find the lengths of *a b* and *c d*? A.—For convenience we first reduce the total length to inches; 30 feet = 360 inches. The total area of the figure is $\frac{18+9}{2} \times 360 = 4860$ square inches, and the area of the divided portions will there-



fore be $4860 \div 2 = 2430$ square inches. Let x = the length of *c d*, and y = length of *a b*, then the length of *b e* will be $360 - y$. As the two portions are to have equal areas, we at once have the equation:

$$\frac{x+9}{2} \times y = \frac{x+18}{2} \times (360 - y) \qquad A$$

which, peforming the operations indicated becomes:

$$x\,y + 9\,y = 360\,x - x\,y + 6480 - 18\,y,$$

and transposing and adding we have:

$$27\,y + 2\,x\,y - 360\,x = 6480. \qquad B$$

Taking the first member of the equation A and its value, we have:

$$\frac{x+9}{2} \times y = 2430 \qquad C$$

which we reduce to $x\,y + 9\,y = 4860$, and thus obtain the value of y:

$$y = \frac{4860}{x+9} \qquad D$$

This value we substitute in equation B, which gives us:

$$\frac{4860 \times 27}{x+9} + \frac{4860 \times 2\,x}{x+9} - 360\,x = 6480$$

which clearing of fractions, etc., becomes: $131220 + 9720\,x - 360\,x^2 - 3240\,x = 6480\,x + 58320$, which reduced gives us:

$$4\,x^2 = 810$$
$$x^2 = 202.5$$
$$x = 14.23 \text{ inch.}$$

and substituting this value in equation D, we have:

$$y = \frac{4860}{14.23 + 9}$$
$$y = 209.21 \text{ inch.}$$

These values of x and y give the required result very closely, as we find by substituting them in equation C:

$$\frac{14.23 + 9}{2} \times 209.21 = 2429.97$$

(36) F. W. G., Rockmont, Wis., sends the following particulars of a valve motion, and desires to know the object of the unequal inside laps and the method of applying the Bilgram diagram to determine the steam distribution: Travel of valve, 2⅜ inches; outside lap, ¾ inch; inside lap at crank end, ¼ inch; inside lap at head end, ⅛ inch; length of connecting rod, 30 inches. A.— The unequal inside laps are introduced to produce an equalized release and compression, which equal laps will not give in a connecting-rod engine. You do not give the length of the stroke; but, judging from the length of the connecting rod, this is probably 12 inches. Assuming that to be the case, and assuming the lead to be 1-32 inch, the Bilgram diagram for a valve having an inside lap at each end of 3-16 inch, which is the mean of those given, is shown in Fig. 1. This is not drawn in the customary way in which the distorting influence of the connecting rod is ignored, by projecting the crank positions to the stroke line by straight lines, but in a manner to show this distortion. The projecting lines will be seen to be arcs of circles having a radius equal to the length of the connecting rod. The release at *a a'* and the compression at *b b'* will be seen to vary in position of crosshead for the two ends of the stroke, both being later for the outward than for the inward stroke. Remembering that additional lap hastens the closing but delays the opening, it is clear that more lap at the crank end of the valve will hasten the closing for the outward stroke, but delay the release for the inward stroke, while less lap at the head end of the valve will delay the closing for the inward but hasten the release for the outward stroke. Taking the actual dimensions of the valve, Fig. 2 shows the Bilgram diagram as applied to it, the events for the outward stroke having been hastened and those for the inward stroke having been delayed, the result being a release which is almost perfectly equalized and compression which is very nearly so, as can be seen by comparing the two ends

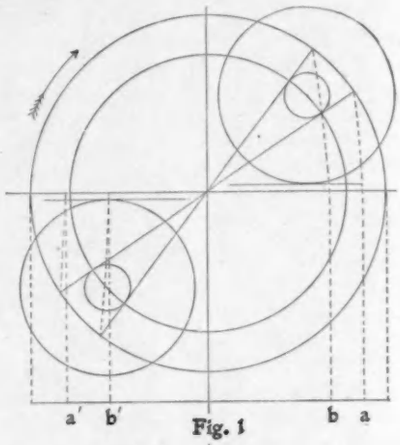


Fig. 1

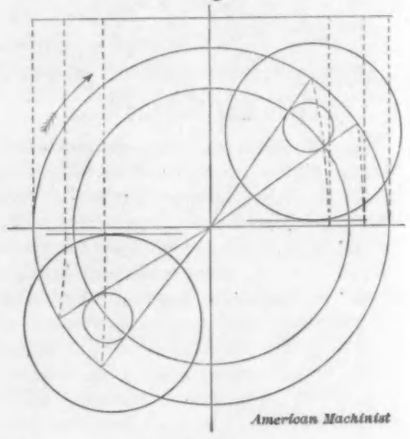


Fig. 2

of the stroke line with a pair of dividers. The result is as good as can be obtained—exact equalization of both release and compression being impossible, as a change in the laps which suits one still leaves a slight difference in the other. Some might consider the equalization of the compression more important than of the release, but we doubt if the slight remaining difference in the compression could be detected on the indicator card. This means of equalizing the exhaust has long been known and is available on all engines having slide valve gears, but it is commonly neglected. Its presence in this engine indicates a design by someone who knew what he was about. Note that it is important that a valve so designed should be placed in its chest as intended by the designer. A valve designed in the common way may be reversed end for end without affecting the steam distribution, but to reverse this valve would double the errors of an uncorrected valve. Unless the correct position is shown by their construction, valves designed in this way should have the words "head end" or "crank end" cast upon them to insure their being placed correctly, since few are aware of the purpose of the arrangement and, more than this, the valve gives no indication of the arrangement on the side which is in sight.

(37) R. E. F., Providence, R. I., refers (1) to the article on ball bearings, by Reynold Janney, published in our issue of January 5, and says: The writer speaks of the spinning about line *o m*, Fig. 1 (Fig. 14 in article). Now, if, as in Fig. 2, we cut away every portion of the ball except that which at some point of its travel touches the trough, we would have the two disks represented. Connect them by an axle. If this, in the position shown, is rolled down the trough it fulfills all the conditions of Fig. 2 as far as bearing surface is concerned, but it does not give any suspicion of spinning. Again, if in Fig. 1 the trough moves and the ball's axis remains stationary, the same relative motions of ball and trough will obtain, but points *v* and *w* will move in the same direction, and there will be no spinning. With the eye stationed at *o* in the case of the rolling ball, the eye must move with *o*, and thus *v* and *w* will be seen to go backwards, merely at different speeds. A.—In Fig. 2 you have essentially altered the problem, as you have in effect imagined the contact reduced to a point, and a point cannot spin. The surface of the ball in Fig. 1, as viewed on the line *o m*, revolves about that line, and since all materials are compressible the contact has appreciable surface and this surface revolves about line *o m*. In the case of the moving trough you have obviously regarded the case as though the eye were looking along the line *o p*. If the eye looks along *o n* the ball will be seen to spin about this line, regardless of whether the ball rolls along the trough or the trough rolls on the ball. (2) In the article by W. E. Ninde, in the

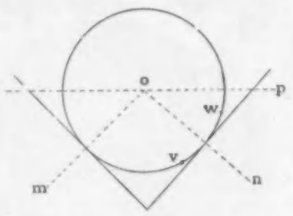


Fig. 1

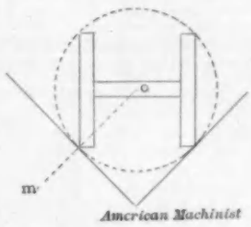


Fig. 2

same issue, should not the second expression

$$\frac{2\pi R\,(R-r)}{2s}$$

for the area of the small triangle have been

$$\frac{2\pi r\,(R-r)}{2s}?$$

A.—Your correction is right. Your derivation of Mr. Ninde's expression for r_1 is very good indeed.

(38) B. H. J., Bloomsburg, Pa., asks (1) for a formula for calculating the lifting power of electro magnets. A.—Full information as to the methods employed in calculating magnets of all kinds can be obtained in Sylvanus P. Thompson's book on the "Electric Magnet." The formula you give is not correct, as it does not take into account the length of the magnetic circuit, and without this the calculation is just as uncertain as the determination of the power of an engine by means of a formula giving the revolutions but not the length of stroke. The true formula is: $F = \frac{A\,B^2}{73{,}000{,}000}$, in which F represents the pull in pounds, A the area of cross section of the poles, and B the magnetic density, or number of lines of force per square inch. When the keeper is in contact with the poles it is not difficult to determine A and B, and under such conditions the pull can be ascertained very accurately; but when there is an air space between the poles and the keeper, these factors cannot be calculated, except approximately, and then the value of F becomes more or less uncertain. (2) A compound-wound motor will maintain practically a constant speed on a constant potential circuit, when load is reduced from full load to no load. Is it not also true that if this reduction is continued to a negative load, i. e., motor is helped, the speed will remain practically constant—the motor running as a dynamo and constituting a dynamic brake? A.—A constant potential motor runs at a constant speed, practically, but not absolutely. The lighter the load the higher the velocity. If the difference in speed between full load and no load is 5 per cent., then with a full load the counter electro-motive force developed by the armature will be equal to 95 per cent. of the electro-motive force of the line current. When the load is reduced to zero the speed will be increased 5 per cent., and the counter electro-motive force will become 100 per cent. Under these conditions there will be no current flowing through the armature, as the counter and the direct electro-motive force will just balance each other. If the speed is increased 5 per cent. above this point the counter electro-motive force will become greater than the direct electro-motive force by 5 per cent., and as a consequence a current will be driven back into the line, and if the line resistance is sufficiently low this electro-motive force may be capable of developing a strong current, and thus producing a powerful brake action. If the armature speed is still further increased the counter electro-motive force will become still greater, and the current generated will increase still more. Full discussion of all the questions raised in your letter is impossible in the space devoted to this department.

The Association of Engineering Societies.

The January number of the "Journal of the Association of Engineering Societies," just received, contains the secretary's report, which shows the association to be in a gratifying state of prosperity. The list of members of the associated societies shows a total membership of about 1,500, while the finances are in an excellent condition. Ever since 1894 the financial condition of the association has been rapidly improving, the excess of assets over liabilities increasing largely, while the annual assessments upon the societies have steadily decreased. In 1898 the annual assessment per member had been reduced to $2, and yet, at the end of the year the assets exceeded the liabilities by nearly $3,000. We learn from the secretary that the $2 annual assessment for 1899 will probably be reduced by a dividend of $1 per member on account of the surplus in the treasury.

In return for the annual assessment the members of the society receive the papers and proceedings, not only of their own societies, but of all the others in the association.

In view of these advantages it is not strange that the association is rapidly increasing its importance and influence by the accession of new societies. During 1897 the Detroit Engineering Society, and in

1898 the Engineers' Club of Western New York, the Louisiana Engineering Society and the Engineers' Club of Cincinnati became members of the association. As the secretary remarks: "Each new society admitted to the association contributes not only to its financial strength, but also to the value of the 'Journal,' and thus increases the inducement of outstanding societies to become members of the association."

Personal.

Mr. W. S. Accles, London manager of the Niles Tool Works Company, who has been in this country on a brief business trip, sailed for home March 25.

Chief Naval Constructor Philip T. Hichborn, United States Navy, was a few days ago the recipient of a cablegram from London announcing that the Institution of Naval Architects of Great Britain had elected him to honorary membership in that society, a life connection of great dignity in naval circles.

Obituary.

William Allen Smith, long in the employ of Cooper, Hewitt & Co., and later connected with the Harvey Steel Company, died March 24; fifty-one years old. Mr. Smith was for many years president of the Alumni Association of the Columbia College School of Mines.

William C. Colburn, president of the Detroit Bridge & Iron Works, died March 12; sixty-two years old. He was born in Vermont and went to Detroit in 1856, entering the machine shop of Charles Kellogg & Co., becoming the secretary of the Detroit Bridge & Iron Works upon its formation.

Edwin Le Roy Harrington, of the well-known firm of Edwin Harrington, Son & Co., of Philadelphia, died March 18; forty-five years old. He was born in Worcester, Mass., and on leaving school went into his father's shop in Philadelphia and grew up with the business, from which he retired several years ago.

Richard A. Tilghman, inventor of the sand-blast process, and a member of the firm of B. C. & R. A. Tilghman, of Philadelphia, died in that city March 24; seventy-five years old. He was a native of Philadelphia, and was graduated from the University of Pennsylvania, after which he studied chemistry. He resided in England intermittently for fifteen years, and the sand-blast was first pushed to commercial success there.

In a previous issue we published a brief announcement of the death of E. S. Taber, of New Bedford, Mass., but were unable at the time to give further particulars. Mr. Taber was seventy-three years of age at the time of his death, and had been president and treasurer of the Morse Twist Drill & Machine Company for thirty-one years, during which time he saw the busi-

(*Continued on page 41.*)

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting, Grant; see p. 16.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Forming lathes. Mer.MachT.Co.,Meriden,Ct.

Agents in every shop to sell my tools; liberal discounts. E. G. Smith, Columbia, Pa.

The Dutton Wet Twist Drill-Grinder is sold by the Garvin Machine Co., New York City.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," price $1, post paid. J.L.Lucas,Prov.,R.I. Send for index sheet.

For Sale—Pond planer, 7 feet by 26 inches; fine condition; immediate delivery. Lock Box 566, Mt. Sterling, Ky.

"Brandt's Triple Expansion Gaskets" are the best for boilers. Randolph Brandt, 38 Cortlandt st., New York.

For Sale—One Sellers 84-inch boring and turning mill. Address The Standard Machinery Co., Mystic, Conn.

Wanted—"American Machinists," Vols. 1 and 2, also Nos. 40 and 43 of Vol. 16. Box 213, AMERICAN MACHINIST.

Wanted—6 or 8 H. P. gas engine, in first-class order and up to date; electric igniter preferred. Address Box 202, AMER. MACH.

Threads and gears; easy rules to cut any thread possible to be cut in the lathe, without algebra, sent to any address for 25c. by G. W. Dixon, Spring Lake, Mich.

Bound volumes of "American Machinist" for 1893 and 1894, cloth, good condition, $3 each; one of 1888, morocco, $4. "Volumes," care AMERICAN MACHINIST.

Best workmanship; reasonable charges; watch, clock and other light machinery; send for samples of punch and die work. Waltham Machine Works, Waltham, Mass.

Expert seeks tabular work; tables carefully calculated to any formula; catalogs written up; metric calculations undertaken. Wm. Cox, 15 Jaques st., Elizabeth, N. J.

Having drawings of electric cars, trucks, snow-plows, sweepers, transfer-tables, want to hear from those desirous of building them; references and sample. Address Box 181, AMERICAN MACHINIST.

Wanted—Parties with a large, modern, well-equipped foundry and machine shop, to consolidate with responsible parties having a first-class article to manufacture. Address Box 200, AMERICAN MACHINIST.

Institutions retiring from business having machine tools, brass or wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

For Sale or Rent—Foundry and machine shop with additional land, in good condition and well equipped for medium heavy work; capacity of foundry 7 tons per day; located on railroad within eight miles of New York; terms easy. Call or address J. F. Sweasy, 26 Nassau street, New York.

For Sale—A well-equipped and desirable machine shop and foundry, adapted to all kinds of work and located in the oil and gas field at Fostoria, O., which has excellent railroad facilities. Call on or address The Brass & Iron Works Co., Fostoria, O.; S. D. Carr, Toledo, O., or S. S. Wheeler, Lima, O.

Wants.

Situations and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisement under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

Experienced mechanical draftsman desires position. Box 204, AMERICAN MACHINIST.

Wanted—Responsible position; 15 years' experience in charge of a shop building knitting machines. Box 209, AMER. MACHINIST.

Foundry foreman wishes position; experienced, heavy or medium castings; N. Y. or N. E. preferred. Box 168, AMER. MACHINIST.

Draftsman of long experience, general and special machinery, office and shop, wishes a permanent position. Box 199, AMER. MACH.

Mechanical draftsman desires to change; six years' experience drafting, some shop; salary secondary with live concern; reference. Box 208, AMERICAN MACHINIST.

A man with extensive experience at designing and building light machinery and tools, wishes position as superintendent or designer. Box 207, AMERICAN MACHINIST.

Experienced foundry foreman desires a change; up to date in modern foundry practice; at present in charge of shop running 60 men. Address Box 210, AMER. MACHINIST.

Mechanical engineer, with 16 years' experience as foreman and supt., wishes to make change from present position; technical graduate and familiar with shop accounts. Address G. W. N., 35 Fayette street, Perth Amboy, N. J.

Situation wanted by an experienced machinist, at present superintendent of an engine shop employing 300 men; high-speed and compound engines. Address Box 211, AMERICAN MACHINIST.

Mechanical engineer wants position as erecting or operating engineer; nine years' experience in shop, drawing room, erecting engines, boilers, etc.; understands electric railway apparatus. Address Box 214, AMERICAN MACHINIST.

A good mechanical draftsman, who is a strictly first-class machinist and toolmaker, and now with one of the best large firms in Connecticut, desires position as draftsman or inspector; extra references. Box 198, AMERICAN MACHINIST.

Thoroughly first-class mechanical draftsman wishes situation (27); technical graduate; 7 years' drawing room, 3 years' shop experience with large and modern concerns; special, automatic, general machinery; moderate wages; Greater New York or vicinity preferred. Box 212, AMERICAN MACHINIST.

Position wanted as factory supt., master mechanic or similar position of trust and responsibility; held similar position for past 6½ years; first-class mechanic and fair draftsman; a hustler; thoroughly familiar with the handling of help on piece work. Apply Box 205, AMERICAN MACHINIST.

Change desired by reliable foreman, 29 years, single, who thoroughly understands how to get highest production on automatic and hand screw machines; have wide knowledge of tool-making and general machine-shop work; exceptional reference furnished; no objection what part of country. Box 197, AMERICAN MACHINIST.

Help Wanted.

Wanted—First-class designer and draftsman for presses and sheet-metal tools. Address Box 183, AMERICAN MACHINIST.

First-class mechanical draftsman; state salary expected, experience and references; location, N. Y. City. Box 203, AM. MACH.

Wanted—At once, 40 machinists for different kinds of work in shop. Address, stating experience, Box 206, AMER. MACHINIST.

Wanted—All-round gear-cutting man for Boston shop; also man for office; give full particulars. Address "Gear," AMER. MACH.

Wanted—Foreman for iron foundry, engine and machinery castings; state age, wages, reference and full particulars. Robt. Wetherill & Co., Chester, Pa.

Wanted—Two or three good machinists can find steady positions in machine shop manufacturing steam engines; lathe hands preferred; state age and experience. Address Box 190, AMERICAN MACHINIST.

Wanted—A first-class draftsman, familiar with rolling-mill machinery, sugar mills and general transmission machinery; give age, experience and salary expected. Address Farrel Foundry & Machine Co., Ansonia, Conn.

Machine-shop foreman wanted, with good experience in general machinery and the management of men; give full particulars about experience, age, least wages considered and references. Box 201, AMER. MACHINIST.

Wanted—A young man, graduate of some first-class mechanical engineering course; man with some shop experience much preferred; permanent employment given to satisfactory man. Apply Vermont Marble Company, Proctor, Vt.

Wanted—Experienced shop foreman for small machine and blacksmith shops in Canada; general mill repairs, locomotives, sta-

tionary and marine engines, boilers and car work; state age, experience, salary, etc. Address Box 185, AMERICAN MACHINIST.

Wanted—Two foremen for machine shop, one on iron and one on brass; 30 to 40 men in room; only those familiar with modern shop methods and of good executive ability need apply; give references, experience and salary expected. Address Box 186, AMERICAN MACHINIST.

Wanted—Draftsman; one actually engaged in making working drawings showing designs and general detailing of highway bridges; must be familiar with present economical construction and shop practice; also one familiar with general structural steel work; first-class estimater. Apply F. C. Austin Mfg. Co., Harvey, Ill.

Wanted—A foundry foreman for a small shop in Southwest Texas making architectural ironwork, machinery castings and brass work; must understand mixing metals and be able sometimes to get good work without making it twice; give reference and salary wanted for a permanent job. "Foundry," Box 196, AMERICAN MACHINIST.

ARE YOU SATISFIED

with your position and prospects? If not, we will help you to a better position and higher pay if you will devote some of your spare time to study at home. Courses by mail in

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Universal Joints

With solid stems and hardened ball.
Machine builders and designers will find them invaluable.

Vanderbeek Tool Works, Hartford, Ct.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO. HARTFORD. CONN.

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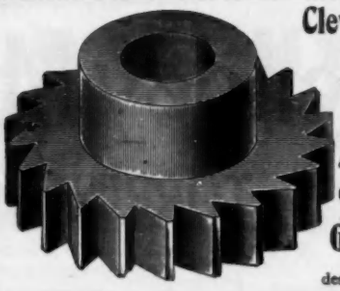
For Special Machinery and Tools
ADDRESS
Mansfield Machine Works, Mansfield, Ohio.



Cleveland Gear Works
W. R. SAWYER, Lessee.
86 Seneca St., Cleveland, Ohio.
GEARS of all descriptions.

THE WARDEN OIL FILTER
is guaranteed to reduce your oil bills at least 50%. Ask your supply house or oil company to send you one on trial. Used by prominent firms throughout the world.

Business Established 9 Years.

THE BURT MFG. CO.
AKRON, OHIO, U. S. A.
Largest Manufacturers of Oil Filters in the World.

"Sensitive Drills That Stay Sold."

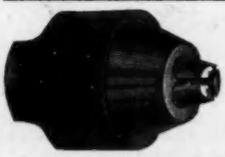
SENSITIVE DRILLS BY THE DOZEN.

Dozen and half-dozen orders for our 10-inch Sensitive Drills no longer call for special comment.

The first two or three were quite surprising, but the novelty has worn off now, and we've come to consider them as a matter of course.

Perhaps we get such orders because it's known we can fill them promptly—'most always have the Drills on hand.

D'Amour & Littledale Machine Co.,
133 Worth St., New York.



Almond Drill Chuck.
Sold at all Machinists' Supply Stores.
T. R. Almond,
83 & 85 Washington St., Brooklyn, N. Y.

COMBINED DRILL AND COUNTERSINK
FOR CENTERING LATHE WORK.

J. T. SLOCOMB & CO.,
PROVIDENCE, R. I. U. S. A.
Chas. Churchill & Co., 9-15 Leonard St., London, Eng

Lathe.

STOP! HERE ARE SOME BARGAINS!

60 Twist Drills, No. 1 to 60, list $8.10; our cash price $2.50. 13 Taper Shank Drills (no block), ¼ in. to 1 in., list $20.00; our cash price $6.00. Screw Cutting Lathe, 10-in. Swing Hollow Spindle, 6 Lathe Tools, 6-in. 4-Jaw Chuck, 2 Dogs, Brass Oil Cups, for foot or power. List $98.00; our cash offer **$75.00.** $75.00

Or send 25c. for No. 24 Cat., showing how you can save up to 50 per cent.

The Frasse Company, 17 Warren St., New York.
Will Remove to 38 Cortlandt St., May 1st.

(*Continued from page 40.*)

ness grow under his general direction from its infancy to its present very large proportions. Mr. Taber held prominent positions in other institutions in New Bedford, having been for eighteen years a director of the First National Bank, and for nine years its president.

Manufacturers.

The Chain Stay Fence Company is to locate a factory at Toledo, Ohio.

The owners of the Darby (Pa.) Gas Works are preparing to build a $150,000 gas plant.

A new five-story factory building is to be erected in Philadelphia for Chas. E. Brown. The building will be 36x95 feet.

Hutzel & Mann, of Ann Arbor, Mich., will build a cement factory near Zukey lake, where they control 175 acres of marl lands.

Wm. Tecklenburg is about to erect for Frederick Fiel, at the corners of Sixth street and Susquehanna avenue, Philadelphia, Pa., a four-story ice-house.

The Union Metallic Cartridge Company, Bridgeport, Conn., is to have an addition made to the plant. This addition will be five stories high.

The Barnard & Leas Manufacturing Company, Davenport, Ia., is building an addition to its present plant which will give the works a third greater capacity.

The Buffalo Forge Company has moved its New York office from the Havemeyer Building to Rooms 114-115, Taylor Building, 39-41 Cortlandt street, New York.

The William E. Gang Company, Cincinnati, Ohio, has been incorporated into a stock company, assuming all of the accounts of the firm of William E. Gang & Co.

The Cheshire (Conn.) Manufacturing Company is soon to erect a brick addition to the factory, preparatory to placing new machinery. The concern is very busy.

Captain S. S. Brown and O. G. Schultz, of the Schultz Bridge Company, Pittsburgh, are making arrangements for the erection of a plant for the manufacture of steel barges.

Wm. Steele & Son, of Philadelphia, are taking bids for the erection of a brick building, 124x187 feet, for T. B. Rice, whose planing works were partly destroyed by fire some time ago.

Bids are being received for the erection of a two-story flange shop, 162 by 100 feet, for the Baldwin Locomotive Works, Philadelphia, Pa. It will be of iron construction, with slate floors.

It is reported that the Empire Molding Works are to occupy a new building on Carroll avenue, Chicago, work upon which has recently commenced by S. H. Moore and R. M. Bissell.

The Board of Trade of Bethlehem, Pa., have published a pamphlet setting forth the advantages of the Bethlehem vicinity for conducting manufacturing operations and for residences of employers and employed.

A contract has just been awarded to the Snow Steam Pump Works by the Water Com-

(*Continued on page 42.*)

What can a

LITTLE SHOP

make? We have working drawings for a modern small machine tool. Just the thing.
Address, Box 195, care AMERICAN MACHINIST.

ENGINE LATHES, W. R. Colcord Machinery Co., 502 N. SECOND ST., ST. LOUIS, MO.

missioners of Olean, New York, for a vertical acting Corliss pumping engine to be controlled by a governor, to be used for the water supply of the city.

The plant of the Dangler Stove & Manufacturing Company at Cleveland, Ohio, was recently destroyed by fire. The loss is estimated at $300,000. The Cleveland Machine Screw Company's works, adjoining, were also destroyed, entailing a loss of $150,000.

It is reported that at Castalia, Ohio, a new cement factory will soon be erected by the Castalia Portland Cement Company, and which, when ready, will be equipped with modern machinery. The officers of the company are W. J. Prentice, president; James Hunter, vice-president; G. W. Hackett, secretary, and G. J. Gorman, treasurer.

The factory of the Patterson Generator Company, of Batavia, N. Y., has been removed to Le Roy. O. F. Woodward has purchased the interests of Ray F. Otis and I. R. Barton, of Batavia, and J. W. Speight, of Brooklyn. The owners now are J. J. Patterson and Mr. Woodward, who will organize a stock company with a capital of $25,000.

New Catalogs.

The Garrett Engine, Boiler & Machine Works, Garrett, Ind., have sent us catalog of the Model gas engine. The catalog is 5¾x8¾ inches.

From the Ingersoll-Sergeant Drill Company, New York, we have received booklet No. 153, which is an index to their Catalog No. 41. The booklet is 3½x5½ inches.

Jenkins Bros., New York, have sent us copy of their 1899 catalog of steam specialties, including valves of different kinds, packing, steam traps, etc. The catalog contains numerous illustrations and is 5x7½ inches.

Fraser & Chalmers, Chicago, Ill., send us catalog No. 54 describing the Sederholm boiler. A very minute description of the construction of this boiler is given, and the catalog contains a number of tables which should prove of interest to steam users. The catalog is standard size, 6x9 inches.

We have just received from the National Meter Company, New York, a copy of catalog describing the Nash gas and gasoline engine. These engines are made with one, two or three cylinders, and the catalog descriptions of the various types are very clear and comprehensive. The catalog is standard size, 6x9 inches.

The Vitrified Wheel Company, Westfield, Mass., has sent us illustrated catalog of emery wheels, emery-wheel dressers, grinding machines and similar devices. The various types of wheels and grinding machines are described in detail. The catalog also contains a cipher code for the selection of grades. The catalog is 6x9¼ inches.

We have received new catalog of the Grant Machine Tool Works, Cleveland, Ohio, describing a line of machine tools, including lathes, semi-radial drills, piston-ring turning machines and plain milling machines. The catalog is neatly arranged, nicely printed, and altogether is in good taste. Its size is standard size, 6x9 inches.

Baldwin Locomotive Works, Philadelphia, Pa., has issued No. 11 of the series "Record of Recent Construction." This contains a paper presented before the St. Louis Railway Club by R. A. Smart, on the "Performance of a Four-Cylinder Compound Locomotive," and the discussion which followed its reading. The pamphlet is standard size, 6x9 inches.

We have received copy of No. 10 of the

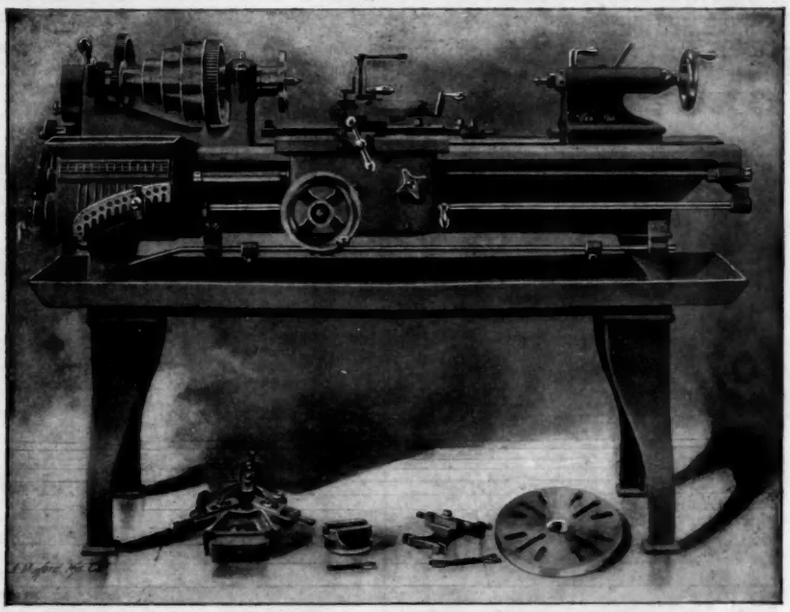
(*Continued on page* 43.)

The Hendey Machine Co.

TORRINGTON, CONN.

This Company is the sole owner of Letters Patents Nos. 470,591, 519,294 and 549,006, granted to W. P. Norton for Improvements in Engine Lathes.

We take this method of notifying the public that we have already commenced suit against infringers of these patents, and that should it be found necessary to the protection of our rights, additional suits will be brought against manufacturers, vendors and users of infringing lathes.



The merits of these improvements have been widely recognized and have been wantonly copied. We shall take vigorous steps to protect our own.

The Hendey Machine Co.,

TORRINGTON, CONN.

AGENTS FOR THE PACIFIC COAST:
Pacific Tool and Supply Co., San Francisco, Cal. J. W. Cregar, Philadelphia Bourse Exhibition.

EUROPEAN AGENTS:
Schuchardt & Schutte, Berlin, Vienna, Brussels. Chas. Churchill & Co., London and Birmingham, England
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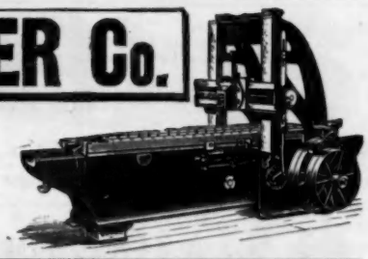
TELLS ALL ABOUT FILES AND HOW TO USE THEM.
NICHOLSON FILE CO., PROVIDENCE, R. I., U. S. A.
LARGEST FILE PRODUCERS IN THE WORLD. S. M. Nicholson, Pres't & Gen'l Mgr.

POWELL PLANER Co.



WORCESTER, MASS.

U. Baird Machinery Co., 125 Water St., Pittsburgh, Pa.
Robinson & Cary Co., St. Paul, Minn.
W. R. Colcord Mchy Co., 502 North 2d St., St. Louis, Mo.
Parke & Lacy Co., Fremont St., San Francisco, Cal.
The Fairbanks Co., 705 Arch St., Philadelphia, Pa.

COMPARE WEIGHTS

WHEN YOU ARE TOLD THAT JENKINS' '96 IS MORE EXPENSIVE THAN OTHER PACKINGS.

Average weight ⅛ inch "Jenkins '96," 11 lbs. to the square yard.
" " ⅛ " Red Packing, 14 " " " "

At 50c. per pound "JENKINS' 96" is not only very much cheaper, but the best joint packing manufactured.

JENKINS BROS. NEW YORK, BOSTON, PHILADELPHIA, CHICAGO.

MACHINE DESIGN. BY FORREST R. JONES.

PART II. FORM, STRENGTH, AND PROPORTIONS OF PARTS.
ix + 353 pages. 179 figures. 8vo. Cloth. $3.00.
Order through your bookseller; or copies will be forwarded, postpaid, by the publishers on receipt of the retail price
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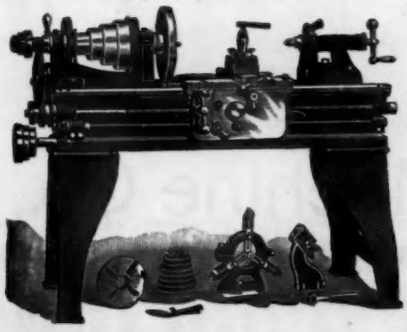
THE BEST ABRASIVE
for all grinding and polishing purposes must be a material as near the hardness of the diamond as possible.

CARBORUNDUM

is harder than any known substance excepting the diamond. It costs a little more than emery but its efficiency is enough greater to make its purchase a matter of economy to the user. Our catalog and price list will tell you about it.
THE CARBORUNDUM CO., NIAGARA FALLS, N.Y.



"Sebastian" Lathes

(13 and 15 inch swing).

Beds Any Length Desired.

High grade, modern lathes at a low price. Each lathe is provided with both screw and rod feeds, as well as power cross feed. Gears to cut all standard threads from 5 to 36 are furnished.

Workmanship, material and design are of the highest order.

You can't find anything better.

We also make a specialty of Screw Cutting Foot Lathes.

Sebastian Lathe Company, 117 & 119 Culvert St. Cincinnati, Ohio.

AGENTS.—Selig, Sonnenthal & Co., London, England. Jn. Tragardh & Co., Goteborg, Sweden. E. Sonnenthal, Jr., Berlin, Germany. R. S. Stokvis & Zonen, Rotterdam, Holland.

(*Continued from page* 42.)

"Record of Recent Construction" series, issued by the Baldwin Locomotive Works, Philadelphia, in which is given a full description, each accompanied by a photograph, of engines recently turned out by that establishment. Locomotives intended for home and foreign service are illustrated. The catalog is standard size, 6x9 inches.

We have received from the B. F. Sturtevant Company, Boston, Mass., a copy of "Bulletin J," describing their system of mechanical draft, and by means of the use of this system it is claimed a more efficient draft can be obtained than by a chimney. Anyone desiring detailed information regarding the subject of mechanical draft can obtain it by addressing the company. The catalog is standard size, 3½x6 inches.

We have received a copy of latest catalog issued by J. E. H. Andrew & Co., Limited, Reddish, near Stockport, England, who are the sole makers of what is known as the "Stockport" gas engine. These engines are made in sizes ranging from 1½ horse-power to 250 horse-power. The construction of this engine is gone into quite fully, as is also its method of operation, the sectional views making this very apparent. The catalog is bound in cloth, and is standard size, 6x9 inches.

The Bullard Machine Tool Company, of Bridgeport, Conn., have gotten out a new catalog. The catalog is devoted to the illustration and description of the Bullard boring and turning mills. These mills are made with one or two heads, as may be desired, and the machines shown range from mills 30 inches to 76 inches. The catalog is tastefully arranged and the printing and half-tone illustrations are fine examples of the printers' and engravers' art. The catalog is 7x9¾ inches, and we understand a copy will be sent to anyone interested, upon application.

The Detroit Graphite Manufacturing Company, of Detroit, Mich., have sent us catalog in which are described graphite paints as made by this company, and also the methods employed in their manufacture. The catalog contains illustrations of buildings, bridges and battleships which have been coated with these paints, and some useful suggestions concerning the painting of structural ironwork are included. The catalog is neatly gotten up, and contains some valuable information for those interested. It contains 106 pages, and is standard size, 6x9 inches.

From the B. F. Sturtevant Company, Boston, we have received a copy of the second edition of catalog No. 96, which is devoted to a very thorough description of various styles of steel-plate fans used in connection with ventilating and heating, and driven by steam pulley and electric motors. These fans are used for exhausting air, gases, smoke, for cooling workmen in mills, foundries, boiler rooms, etc. The arrangement of the fans and engines for driving them is compact, and occupies the minimum of space. The catalog contains 132 pages and measures 6½x9 inches.

From H. W. Caldwell & Son Company, Chicago, Ill., we have received copy of catalog No. 25, which is very complete. In it is described a large variety of machines used in the elevating and conveying of materials. The Caldwell helicoid conveyor is very minutely described. The catalog contains descriptions and prices of specialties for grain elevators, cement works, malt houses, sugar refineries, etc. At the back of the catalog there are a number of useful tables and other data which should prove of service to those interested in the installation and running of plants of the character referred to. The catalog contains 380 5x7½-inch pages. We are informed that the company referred to will be pleased to send a copy to anyone interested.

D. SAUNDERS' SONS,

Manufacturers of the Original

TRADE I. X. L. MARK.

Pipe Cutting and Threading Machine.

BEWARE OF IMITATIONS. None genuine without our Trade Mark and Name

Steam and Gas Fitters' Hand Tools, Pipe Cutting and Threading Machines for Pipe Mill use a specialty.

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The Long & Allstatter Co.

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Manufacturers of

Single, Double, Horizontal,
Multiple, I Beam, Boiler . . .

PUNCHES.

Cross-cut, Splitting, Bar Iron,
Angle Iron, Gate, Beveling . . .

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MACHINE TOOL BUILDERS

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Steel Ball Crank Handles and Levers finished ready for use.

SUPERIOR TO CASTINGS OR FORGINGS.

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Drills for Light Work.

We make drills from one to eight spindles, hand and automatic feed. Send for price of the

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Double Head Traverse Drills; also adjustable Two Spindle Drills, Tapping Machines, Cutter Grinders, Surface Grinders, Centering Machines.

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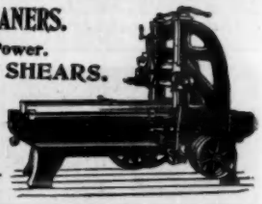

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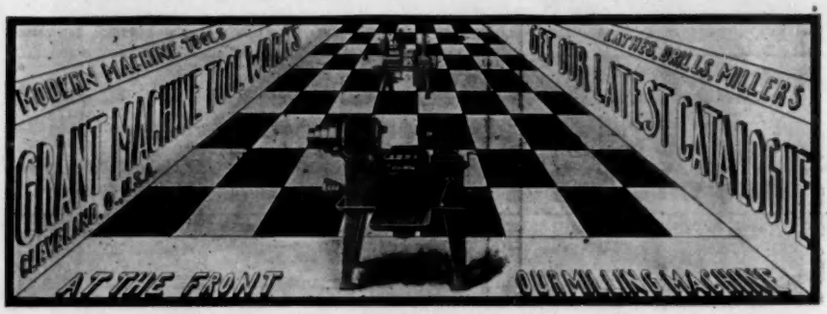

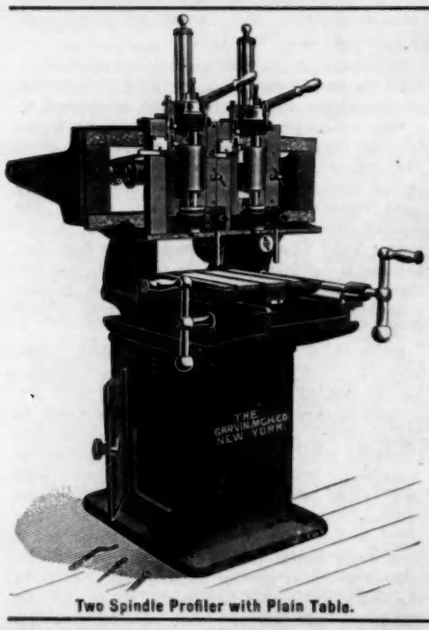

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Profiling Machines,

One and Two Spindles, Plain and Circular Tables, Power Feed.

Metal Working Machinery,

For all purposes.

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